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Development of Machine Tools in New England

By GUY HUBBARD

The fourth article—The ornamental period in machine design—Machine for ruling paper—History of the dividing engine for graduating scales and rules

OLD-FASHIONED machinery, at least that which was built for sale, usually had cast iron frames of most fanciful and illogical design, being embellished with such details as scroll work, claw feet, delicately carved legs, and fluted columns—sometimes Ionic and sometimes Corinthian. It is frequently assumed, probably because of the prevalence of architectural details in the early machine tools, that the designers themselves must have been architects who had shifted over into the less artistic profession of machine design, carrying into their new field their structural ideas.

It appears that both pattern making and machine drafting, as we know these related subjects today, really developed during the early part of the 19th century, and that they were offshoots of cabinet making, evolving in the following way: Early machinery was built almost entirely of wood, not only because of the scarcity of metal but also because of the lack of facilities for working it. This naturally brought machine building into the realm of the cabinet maker, who was equipped with the necessary knowledge and tools for this grade of work. Whatever iron parts were used were generally forgings, so that the blacksmith also had a hand in the matter.

Drawings Seldom Used

Drawings, other than rough sketches upon boards, were seldom used, the machine being built "out of the head" of the inventor, necessary changes being easily made in the wood as the work progressed. This "cut and try" method persisted even after the use of castings became more prevalent, novel machines being built from wooden models upon which the experimental work was done before the permanent iron structure was erected. As the Patent Office at that time, and in fact for many years thereafter, required a small sized working model of an invention with the written specifications, instead of the "formal drawings" furnished today, these interesting experimental wooden models frequently were made to serve at least a double purpose.

A cabinet maker usually built the model if the inventor did not do so himself and it is natural that he would also build the patterns, as they closely resembled the details of the model. Thus, pattern making gradually developed as a branch of the cabinet makers' trade. Accustomed to building furniture of highly decorative carved designs and being acquainted with the design of architectural details, through the making of columns and other fancy "trim" for the builders of the fine mansions of that period, it is not surprising that when these skillful and artistic craftsmen undertook the rather prosaic task of building a set of machine patterns, they often tried to emulate Leonardo da Vinci the artist-engineer, and as a result produced machinery which might have been a compliment to Chippendale and Sir Christopher Wren, but extremely painful to Prof. Francis Reuleaux.

Lemuel Hedge, Blacksmith

It was during this transition or formative period in the machine industry that Lemuel Hedge began his mechanical training. Lemuel Hedge, whose portrait is shown in Fig. 18, son of Solomon Hedge the village blacksmith, was born at Windsor, Vt., Nov. 2, 1786. During his boyhood he attended for a short time the rather primitive village school, at the same time receiving his early mechanical training as a helper or "striker" at his father's blacksmith shop. Lemuel Hedge was a natural mechanic and was soon attracted to the finer classes of work. As soon as his brief schooling was over, he served a regular apprenticeship under one of the early Windsor cabinet makers and became a skilled worker in wood as well as an all around mechanic, both on account of his natural ability and because of his previous training in the blacksmith shop. After his release from apprenticeship, he set up as a cabinet maker at Windsor and in 1813 went into partnership with one William Ayres, under the firm name of Hedge & Ayres.

There held forth in Windsor at that time, a character by the name of Thomas Pomroy who was the publisher

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of the locality—carrying on the combined businesses of printer, book binder, book seller and stationer in a shop in the Tontine Block, a wooden building which was the largest in the business district of the village. In those days paper for blank books was ruled by hand in the manner shown in Fig. 19 and it was a tedious and expensive process. Lemuel Hedge noticed this at the shop of Thomas Pomroy and his mind became set upon improving it.

His first step was to invent an improved spring-pen ruler, patented June 21, 1815, and this was followed by his revolving ruling machine in which was incorporated his spring pen, patented March 3, 1817. These patents were issued to Lemuel Hedge and Thomas Pomroy, the two men meanwhile going into partnership under the name of Pomroy & Hedge, for the purpose of manufacturing the Hedge revolving ruling machine. This machine, shown in Fig. 20, was the first novel and complicated mechanical device to be

FIG. 18—LEMUEL HEDGE, PIONEER WINDSOR INVENTOR
(From a miniature in oil)

produced in the Windsor village, and was the basis of the best modern ruling machines. Of it the *Albany Register* had the following to say at the time of its introduction in 1818:

". . . We witnessed with much pleasure (at the shop of Van Vechten & Seymour, blank book manufacturers and fancy binders at Albany, N. Y.) an improvement which cannot but be interesting to the merchant and mechanic. It was a machine which ruled *both sides of the sheet at once*, and with a rapidity and beauty truly astonishing. By means of this labour saving machine, paper can be ruled about 75 per cent cheaper than heretofore. Those acquainted with the process of ruling blank books, can appreciate its value, when we inform them that two lads in the shop have repeatedly faint-lined a ream of paper on both sides in twelve minutes."

Pomroy & Hedge occupied the lower floor of the Tontine Building, which was 91 x 40 ft. and three stories high and carried on the publishing and stationery business along with the cabinet making and machine business—a very curious combination.

As soon as the success of the Hedge ruling machine seemed assured, the firm sold out its book and stationery business and in the Fall of 1818, made preparations to manufacture the ruling machine upon a large scale. In the midst of these preparations, early in the morning of Nov. 25, 1818, the Tontine Building was burned to the ground and it required several hours of combined efforts of the citizens of Windsor and Cornish to save the entire village from the same fate. Deeds of heroism are recorded, such as the descent of one Zeba Toot through the flames from the third story calmly bearing a barrel of rifle powder on his shoulder.

On account of this fire, which Pomroy & Hedge claimed to be of incendiary origin, the budding industry was completely wiped out; even to its books and plans, at a loss of $3,500 and Lemuel Hedge set out on along journey in an attempt to recoup his fortunes. He traveled through the West and South selling state rights to manufacture and sell his ruling machine and through this procedure (which was customary at that time) its use became widespread without any great benefit to the young inventor.

Making Musical Instruments

After this journey, Hedge returned to Windsor and again set up as a cabinet maker, now becoming interested in the manufacture of musical instruments. He patented and manufactured an improved bass viol. Later he brought from England a skilled organ builder and added high-grade pipe organs to his list of products. Many large Hedge organs, very fine instruments with mahogany cases, were built into New England meeting houses at the time when organ music first ceased to be looked upon as a sacrilege and some of them are very likely still in use.

His keen and restless mind was constantly at work on inventions and improvements and on June 20, 1827, he patented his "Engine for Dividing Scales," mentioned in Bishop's "History of American Manufactures" as one of the notable inventions of the year. This machine for the rapid and accurate marking and numbering of rules and mechanics' scales was evidently suggested by his revolving ruling machine of 1817 and was of national importance in the development of the machine industry.

It has been generally believed that Joseph R. Brown of Providence, R. I. and Samuel Darling of Bangor, Me., were, in 1850 and 1852 respectively, the American pioneers in the field of automatic graduating engines and the importance of their work in the rise of interchangeable manufacturing by cheaply and rapidly multiplying accurate scales has frequently been pointed out. In view of the following facts it would appear that Lemuel Hedge, whose engine for dividing scales antedated those of Brown and Darling by more than twenty years, is also entitled to no small measure of credit for the important work of unifying the linear-measurement system of this country.

The original Hedge engine, shown in Fig. 21, is clearly described in the patent, which, because of its importance, was one of those restored to the records after the unfortunate Patent Office fires of 1836 and 1877. It consisted of eight important details, namely, a frame, a sliding carriage, index plates, detents, detent levers, marking chisels, hammers, and a cam wheel. The frame and carriage were something like the bed

and platen of a metal planing machine, the bed being more than twice as long as the carriage and the carriage somewhat longer than the scale to be divided. The carriage had at the front, a clamping device for holding scale blanks and at the rear provision for holding changeable index plates. The carriage, which moved on the bed from right to left, was provided with a weight feed.

Fastened to the frame of the machine, and projecting over the index plate, was an L-shaped block in which

FIG. 19—RULING PAPER BY HAND
(From an old wood cut)

were pivoted, so as to lie parallel to the carriage and side by side above the index plate, four hooked bars about six inches long and numberd 1, 2, 3, and 4. The hook or detent ends of these bars were normally pressed down by flat springs so as to engage with the index plate. The four detent levers were pivoted side by side on the frame by a link, so as to lie at right angles to the free end of a separate detent-bar. The rear ends of the detent levers, beyond their fulcrums, were in a position to be acted upon by a cam drum. The cam drum, some ten inches in diameter, was supported on the rear of the frame with its axis above and parallel to the carriage, and was provided with two sets of movable-pin cams upon its surface, the assembly being much like the drum of a music box. One set of these cams was designed to lift the detents one by one from the index plate, while the other set was designed to trip the marking hammers.

How the Divisions Were Marked

The markers themselves were short vertically-sliding chisels with edges of different widths, supported perpendicularly above the scale in movable bearing-blocks, their cutting edges being normally kept slightly above the surface of the scale by coil springs under their heads. Resting upon these chisels were the heads of miniature trip hammers, having helves pivoted above the detent levers and actuated by the trip pins in the cam drum. The index plate was made of four strips of ivory or metal, one for each detent, and each strip was pierced with an accurately-spaced row of holes.

The operation of graduating a two foot-rule to eighths of an inch was as follows: A blank at least an inch longer than the finished rule was clamped in place in the front of the carriage and four marking chisels were set in place. No. 1 for inch marks, No. 2 for halves, No. 3 for quarters and No. 4 for eighths. As set up from left to right, No. 1 came first, No. 3 second, No. 2 third, and No. 4 fourth, their edges being spaced exactly half an inch apart. An index plate of four sections or ranks, having holes in each rank exactly half an inch apart, was now clamped in place with the four ranks arranged so that the holes in the second rank came exactly one eighth of an inch ahead of those in the first, those of the third one eighth ahead of those in the second, and those of the fourth one eighth ahead of those in the third. Eight detent cams were placed upon the drum, so that in one revolution each of the detents was acted upon twice. The hammer which struck chisel No. 1 was acted upon once, that which struck chisel No. 2 once, that which struck No. 3 twice, and that which struck No. 4 four times, in the following order: the cam which tripped the hammer of chisel No. 1 was placed half way between those which raised detents Nos. 4 and 1. Commencing the operation, detent No. 4 was first raised leaving detent No. 1 to hold the carriage (which was drawn forward by a weight attached to it by a cord passing over a pulley at the end of the frame), chisel No. 1 meanwhile striking an impression; then detent No. 1 was raised, allowing the carriage to jump one eighth of an inch before being stopped by detent No. 2, which held it while chisel No. 4 struck an impression; next detent No. 2 was raised and the carriage jumped an eighth of an inch before being stopped by detent No. 3, which held it while chisel No. 3 struck an impression; next detent No. 3 was raised and the carriage jumped an eighth of an inch to detent No. 4, which held it while chisel No. 4 struck a second impression; next detent No. 4 was raised and the carriage jumped an eighth of an inch

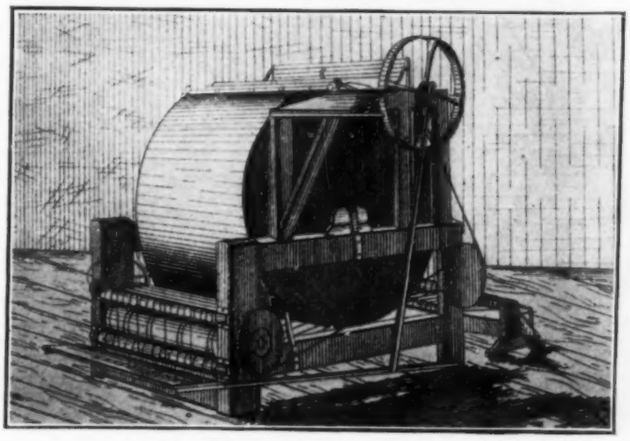


FIG. 20—THE HEDGE REVOLVING RULING-MACHINE
(From an old wood cut)

to detent No. 1 which held it while chisel No. 2 struck an impression; next detent No. 1 was raised and the carriage jumped an eighth of an inch to detent No. 2, which held it while chisel No. 4 struck a third impression; next detent No. 2 was raised and the carriage jumped an eighth of an inch to detent No. 3, which held it while chisel No. 3 struck its second impression; next detent No. 3 was raised and the carriage jumped an eighth of an inch to detent No. 4, which held it while chisel No. 4 struck its fourth impression.

The cam drum had now made one revolution and one inch of the rule had been passed over, the several chisels having given their appropriate impressions. As the four chisels occupied a space of two inches and the rule had moved but one inch, blanks were necessarily left in this first inch but the second, and all succeed-

ing inches, would be fully graduated. This will account for the extra inch left on the blank, which was cut off when the rule was finished. In case expensive wood, ivory or metal scales were being divided, this waste was avoided by inserting a block of wood at the left to receive the impressions of the first inch.

When it was desired to divide a scale into sixteenths of inches a chisel with two edges, one sixteenth of an inch apart, one for eighths and one for sixteenths, was substituted for chisel No. 4, so that no change in indexing was required. Smaller divisions to almost any degree of fineness were cut with great accuracy by the use of an ingenious reducing or pantograph attachment. This attachment consisted of an oblong frame about eight feet long and two feet wide, which was arranged to slide lengthwise vertically in another frame, attached to the rear of the engine bed at the left-hand end. On the front surface of the sliding frame was a straight bar, extending diagonally from the lower left-hand corner to the upper right-hand corner. The left face of this wedge or cam, was placed in contact with a roll at the left end of the rear of the carriage and the pull of the carriage drive-weight was reversed, so that it served to keep the roll in contact with the face of the cam. An index plate similar to the one used before, but eight feet in length, was fastened vertically to the back of the sliding frame, opposite the cam drum and a special set of spring detents (as many as the ranks of the index plate) were located so as to bear upon the plate, being operated by the cam drum through a special set of detent levers. As the machine was operated with these attachments, the detents were raised one by one and the hammers operated as before. Each time a detent was raised, the frame dropped by gravity a unit distance till stopped by another detent. It is evident that when a frame proportioned as above descended eight feet, the carriage moved only two feet—hence the scale was graduated four times as fine as the index plate. In other words an eight-foot index plate carefully divided to eighths of inches would produce a two-foot scale very accurately divided to sixty-fourths of inches.

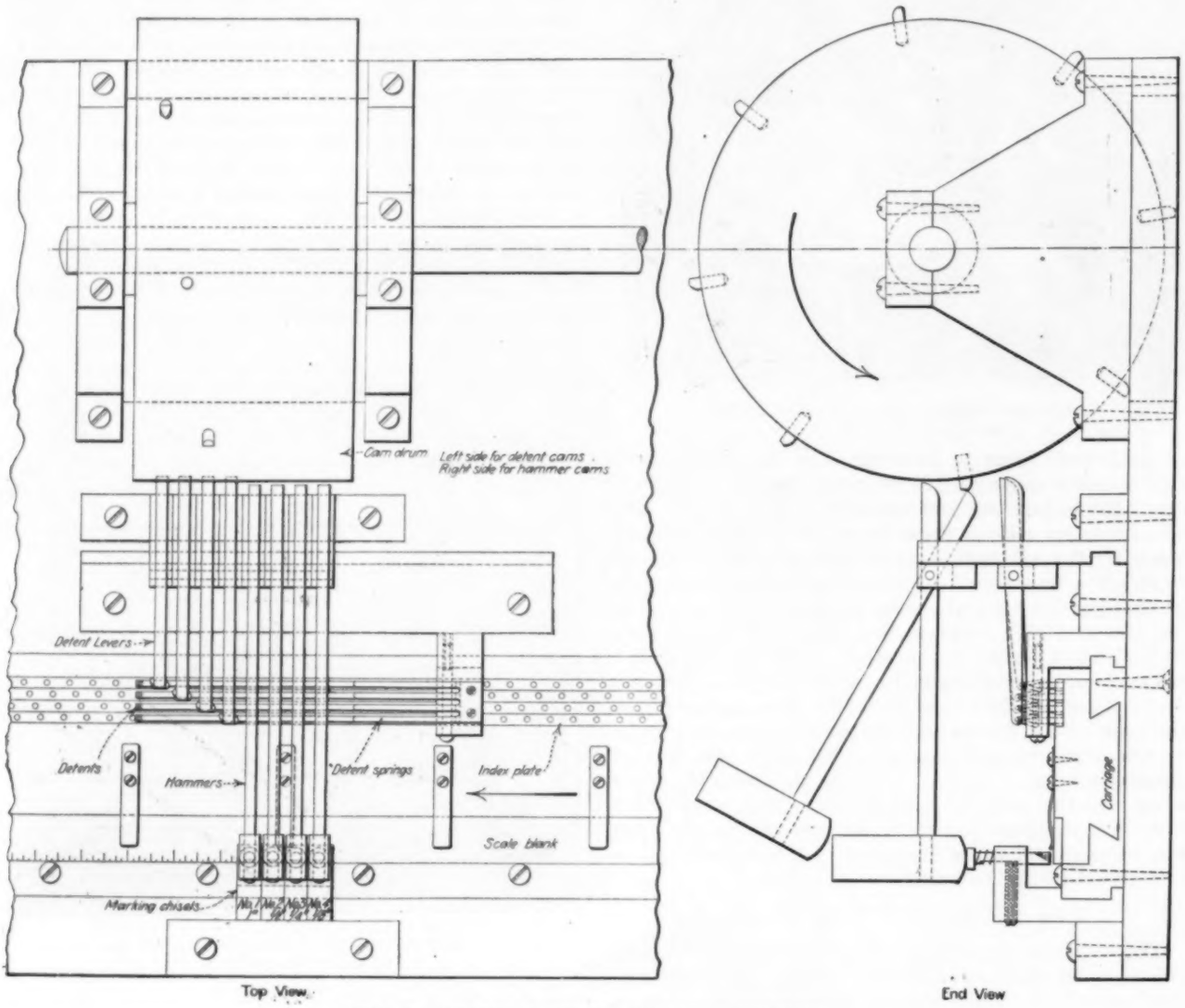
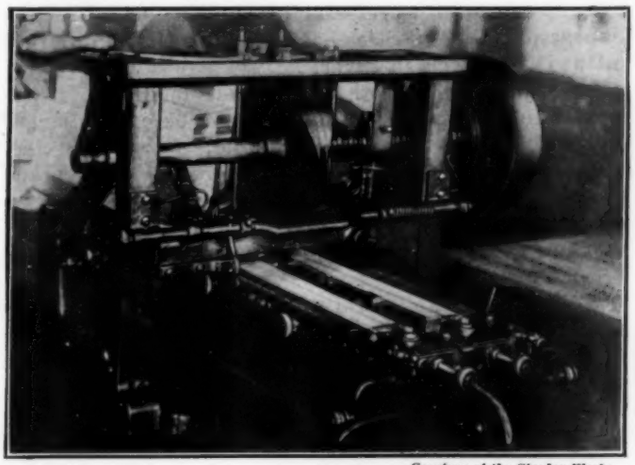


FIG. 21—ORIGINAL HEDGE DIVIDING ENGINE

Another ingenious attachment, was that used for accurately copying standard or special scales and by which they could be rapidly reproduced. This attachment consisted of a disk somewhat greater in diameter than twice the length of the scale, which was substituted for the frame mentioned above. The disk had a

blank index fastened about its periphery and upon its front face it had a spiral cam, arranged to allow the roller mentioned above to move from the center to the periphery of the disk during revolution, being in reality the wedge of the previous instance, coiled up. The distance of the face of the spiral cam from the center of the disk, increased in exact proportion to the degree of revolutions of the disk. The disk was revolved by a weight attached to a cord wound upon its axle, the weight being sufficient to propel the carriage against the counter pull of the regular drive-weight.

The master scale to be copied was placed in the front of the carriage and chisel No. 1, now used as a marker, was set above the first graduation. A special set of detents, also used as markers, were set in place at the top of the disk with their edges resting upon the blank index. The carriage was then indexed by pressing the



Courtesy of the Stanley Works

FIG. 22—IMPROVED HEDGE DIVIDING ENGINE (1836) STILL IN USE AT STANLEY RULE & LEVEL CO., NEW BRITAIN, CONN.

edge of chisel No. 1, carefully into the first division of the master scale, after which a second operator pressed an impression into the blank index by striking the first marker detent a light blow. The carriage was then moved to index the next graduation of the master with the edge of chisel No. 1, the movement of the carriage allowing the disk to revolve slightly. The second operator now struck an impression from the next detent—this operation being repeated through the length of the master scale. When the marking process was completed, the light marks in the index plate were deepened to hold detents and it was checked back by running the engine with the master scale still in place. Any inaccuracies were corrected by filing the slots in the index until the markers registered perfectly with the master.

Scales Automatically Duplicated

After this was carefully done, the master was removed, and a blank took its place, the engine now being ready to automatically duplicate the master scale as many times as required. Scales were rapidly numbered in the Hedge engine by substituting for the regular cam drum one as long as the scale, having as many hammer trip-cams as there were numbers, the cams being arranged in a helical path about the drum. A row of dies carrying the numbers was substituted for the marking chisels, each having its own hammer. The divided scale was clamped in place and the dies were set so as to register with the proper graduations. As the drum was revolved, the hammers were tripped one after the other and in one revolution the entire scale was numbered. This could be carried on almost as fast as the scales could be put in place.

Hedge also proved himself to be something of a mathematician by making special index plates, cams and chisels by which the complicated trigonometric and logarithmic lines of Gunter's scale could be rapidly reproduced.

Sale of the Dividing Engine

Hedge built and for sometime operated his first dividing engine at Windsor, but not being able to finance an extensive rule and scale manufactory in that town, he interested E. A. Stearns of Brattleboro, Vt., in the proposition. About 1830, the firm of E. A. Stearns & Co. was organized and Hedge and his dividing engine removed to Brattleboro, where he spent the next ten years in perfecting his machinery and in manufacturing scales, which were sold in great numbers. In the course of this work, he not only invented a revolving planing machine and the familiar carpenters' folding two-foot rule but also brought out an improved dividing engine as shown in Fig. 22. In this improved engine, built about 1836, cam-operated engraving tools were substituted for the hammer-operated marking chisels of the original machine. The improved machine was capable of graduating two scales at once and was not only more rapid but, on account of its nicer construction, was more accurate than the first machine.

In 1840, Hedge sold out his interest in E. A. Stearns & Co. and went to New York City. E. A. Stearns & Co. continued to do an excellent business under that name at Brattleboro until 1862, when it sold out to Charles L. Mead. In 1868, Mr. Mead became treasurer of the Stanley Rule & Level Co. of New Britain, Conn., and consolidated his business with that company—the Hedge machinery being removed to New Britain. The original dividing engine from Windsor continued to operate there for many years and to this day one of the Hedge engines of 1836 is used at the Stanley works to divide its high-grade ivory rules, in preference to the modern types of machines.

Nick-Bend Test for Wrought Iron

All of the laboratory work in connection with this investigation by the Bureau of Standards has been completed, and the report is being assembled for publication. The general conclusions which the results appear to warrant are given below. Crystalline areas appear most readily in the fractures obtained in the nick-bend test of those wrought irons in which the individual slag threads are small and uniformly distributed. The presence of "steel" in wrought iron, since it is conducive to this condition, favors the formation of such crystalline areas. The converse, however, is not true.

A crystalline area in the fracture is not a sure indication of the presence of "steel" in such wrought iron. The test cannot be used as a means for detecting high-phosphorus iron. A rapid application of the load in the nick-bend test, usually by impact, is necessary for the formation of the crystalline areas. Distinction should be made between the crystalline areas on the tension and on the compression sides of the tested bar. The latter, in general, are not to be regarded as indicative of the structural condition of the metal.

Unilateral or Bilateral Tolerances?

By Earle Buckingham

WE LIKE to think that we, in this present age, have advanced, technically at least, far beyond our forefathers. It would be to our discredit if we had not because we have available, either by written word or tradition, all of the accumulated experience of former ages as well as the little direct experience we ourselves have gathered.

If we go on the theory that everything new represents progress it is safe to say that we have advanced in many respects. Sometimes, however, when we try to go to the root of things and ponder on fundamentals we get a distinct shock.

The general impression exists that the subject of standards and tolerances is distinctly modern. This is not the case. The subject is almost as old as the race of man. For thousands of years it has been considered in its many aspects. Yet, despite all these centuries of accumulated thought and experience, we seem no nearer a solution than when the subject was first introduced.

Today we are wrangling over the matter of whether to use unilateral tolerances or bilateral ones. Lifelong friendships are almost shattered because of opposing views on this subject. The names of the two types of tolerances may be new, but the problem itself is old—older than the Pyramids.

Let us forget for a little while our personal prejudices on this subject and spend a little time and thought on the treatment of the problem in earlier days.

It may seem strange to use the Bible as an engineer's hand-book. Although it was written several thousand years ago, the Bible contains the fundamentals of modern law, sanitation, military science, ethics, etc. A few passages deal pertinently with this subject.

Ye shall do no unrighteousness in judgment, in meteyard, in weight, or in measure.

Just balances, just weights, a just ephah, and just hin, shall ye have: I am the Lord your God, which brought you out of the land of Egypt. (Leviticus, XIX-35, 36.)

Thou shalt not have in thy bag divers weights, a great and a small.

Thou shalt not have in thine house divers measures a great and a small.

But thou shalt have a perfect and just weight, a perfect and just measure shalt thou have; that thy days may be lengthened in the land which the Lord thy God giveth thee. (Deuteronomy, XXV-13-15.)

Give, and it shall be given unto you; good measure, pressed down, and shaken together, and running over, shall men give into your bosom. For with the same measure that ye mete withal, it shall be measured to you again. (Luke, VI-38.)

Although no definite tolerances were specified, it is evident from the foregoing that a variation in one direction was commendable, while any variation in the opposite direction was far otherwise.

The ultimate purpose of mechanical standardization is economy. This economy can only be obtained by a process of simplification and reduction in number of stock sizes of any given detail. This in turn must permit the simplification and reduction in number of stock sizes of mating details, and of tools and materials used to produce them. A careful analysis will show that in the vast majority of cases a unilateral tolerance will achieve this result while bilateral ones will not.

Usually a demand for a bilateral tolerance conceals some ulterior motive. For example, some years ago our Congress passed a law establishing definite tolerances of weight for various package goods. A bilateral tolerance of plus or minus a definite quantity was specified. The ostensible reason for establishing this practice was two-fold. First, by permitting the variation in either direction, the average weights would be very close to the absolute standard. Second, by specifying this bilateral tolerance, the matter would be handled impartially as regards the buyer and seller.

From time to time, tests are made of the weights of such package goods. Although very few, if any, are found outside of the specified limits, yet the average weight of any considerable number of packages has always been found to be below the basic weight.

This same practice has been applied in most other cases of legislation, where definite tolerances of size, weight, or capacity are established. The actual results in practice in many cases has been such that a different method is gaining in favor.

In France, on the other hand, the tolerance is unilateral and the variation must always be on the larger side. The object here is also twofold. First, to protect the purchasers, as they are in the largest numbers and usually need protection most; and second, to hold variations to a minimum, because as the seller usually provides the weights and measures used in trade, it is to his interest to have the variation as small as possible.

The use of a unilateral tolerance means the maintenance of a basic standard—a sharp dividing line between right and wrong. The use of a bilateral tolerance, on the other hand, means a departure from such basic standards, to as great an extent as will be condoned, and in the direction which is of the greatest selfish advantage to the producer.

Invar and Related Steels

Circular No. 58 of the Bureau of Standards on Invar and Related Steels, has recently been revised, and the second edition can be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 30c. a copy.

This circular is mainly a compilation of data obtained during the last 30 years by various investigators on the different properties of nickel steels. Particular attention is given to "invar," a nickel-iron alloy containing about 36 per cent nickel and possessing an extremely small thermal expansivity at ordinary temperatures, the mean coefficient of linear expansion between 0 and 40 deg. C. being of the order of 1 to 2 millionths. The results of investigations made on the various properties of the nickel-iron alloy series have been presented largely in diagrammatic and tabular form.

Following an historial account of development of nickel steel and studies of their properties, the nature of the anomalies in behavior met with in these steels and characterized by their irreversible and reversible phenomena are discussed in the light of results obtained on their various physical properties. The constitution and microstructure of these alloys are first dealt with, and next the rather extensive studies made on the magnetic properties. A magnetic transformation (Curie points) diagram has been plotted from the observation obtained magnetically, for the most part, by various investigators.

Repairing Locomotives in a Machine-Tool Shop

SPECIAL CORRESPONDENCE

Conclusion—Portable floor and cylinder boring machines—Repairing driving boxes—Regrinding valves, joints, links and link blocks—Minor boiler repairs

THE FLOOR BORING machine is of inestimable value in locomotive repairs. There are many holes in the supporting parts that become worn out of shape while the engine is in service that can be restored to their original condition of roundness without loss of time and without dismantling the engine for the purpose.

The machine shown in Fig. 20 is set up for reboring

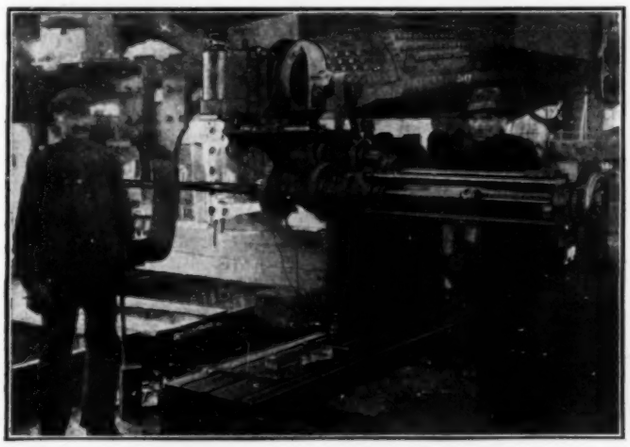


FIG. 20—THE FLOOR BORING-MACHINE

the holes in the spring hangers. The entire machine from floor plate to driving motor, may be picked up by one of the cranes and deposited wherever its services may be needed.

The cylinder boring machine, Fig. 21, is available for reboring cylinders and valve chambers and may be applied to any engine anywhere, as it is suported by a spider bolted to the open end of the cylinder and held by the studs that ordinarily hold the cylinder head in place. It is driven by a separate electric motor.

The driving boxes of a locomotive have not only to support the greater part of the weight but all of the forward thrust and a large part of the side thrust due to the swaying of the engine as well as its tendency to maintain a straight course when rounding a curve. The boxes are steel castings fitted with crown bearings of brass or bronze for the journals of the driving axles and also are faced with the same material on one side to bear against the hubs of the driving wheels. Both the crown bearings and the hub liners require frequent renewal.

Sometimes the hub liner is made as a separate piece, like a slip washer, and bolted to the box with flush head screws of brass; oftener it is cast in place and finished on the boring mill at the same time the crown bearing is finish bored. Fig. 22 shows such a box prepared with a dovetailed annular groove in the side to anchor the hub liner. Fig. 23 shows the same box after the hub liner has been cast and ready for the facing operation.

There are many valves and joints that need to be re-ground on every locomotive that comes into the shop for repairs, and so far as is possible this work is taken care of in the valve department, though there are necessarily many places where the work has to be done upon the engine. Often the superheater units are taken out, either for repairs upon the units themselves or to allow repairs to be made upon the flues, which would otherwise be inaccessible because covered by the units.

The joints of the superheater units are hemispherical

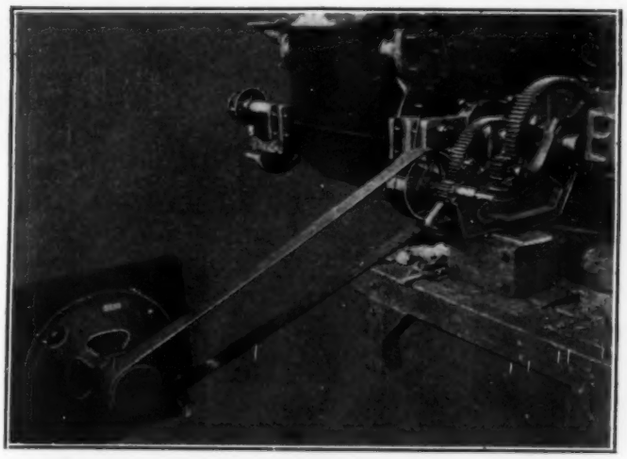


FIG. 21—PORTABLE CYLINDER-BORING MACHINE

in shape and are re-ground with lead laps of corresponding shape, revolved by means of an air motor.

The motor and attached lap are held in the hands of the operator who rocks the outfit about with an irregular gyratory movement as the lap revolves, serving to distribute the lapping compound evenly between the lap and the joint-face, thus producing a smooth hemispherical surface that, when bolted to a correspondingly lapped surface in the header, will insure a steam-tight joint.

FIG. 22—A DRIVING BOX PREPARED FOR CASTING THE HUB LINER. FIG. 23—AFTER CASTING THE HUB LINER

Some of the larger joints are of the same shape and are re-ground in the same manner with suitable laps, but valves or other joints having conical mating surfaces are ground by hand with the usual reversing movement and constant lifting out of contact for the purpose of distributing the compound.

On slide-valve engines the valves and seats are first scraped to true surface plates, after which they are scraped together—a job that must be done in place. By far the greater part of the engines that come in for repairs are of the piston- or "spool"-valve type, and any work to be done upon the valves is taken care of in the valve department.

About the only thing that can be done to piston valves is to fit them with new rings, though it may sometimes be necessary to build up the valve body by welding as is done in the case of the main pistons. The seat of a piston valve is a round bushing, and if it becomes worn to any extent it is drawn out and replaced by a new one.

A valve that causes more or less trouble from steam leakage is the throttle, and it has to be looked after very carefully. In most modern locomotives this valve is of the double poppet, or balanced type, an example of which may be seen in Fig. 24. When in place in the boiler the valve housing *A* is entirely surrounded by live steam and is therefore subjected externally to boiler pressure. There is pressure upward under the lower ring as well as pressure downward upon the upper part of the valve. Because the area of the latter is slightly larger than the former, the preponderance of pressure is downward and the valve remains closed.

As shown in this figure, the valve is in its proper place in the housing and has attached to it a wooden handle by means of which it may be turned and lifted during the re-grinding operation. Another and exactly similar valve is shown on the bench at *B*.

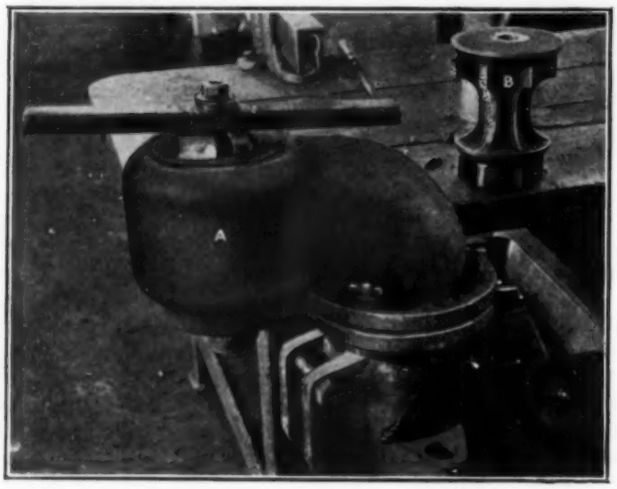


FIG. 24—GRINDING IN A LOCOMOTIVE THROTTLE VALVE

To grind such a valve, both conical faces are covered with the lapping compound, usually flour emery suspended in oil, and the valve is rotated back and forth by means of the wooden handle, lifting it every turn or two to allow the compound to re-distribute itself evenly between the surfaces.

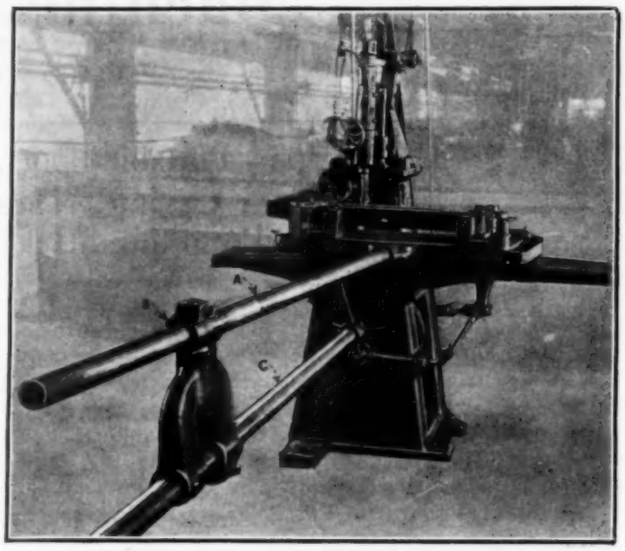


FIG. 25—THE LINK GRINDING MACHINE

The links of a locomotive reversing gear are peculiarly subject to wear, both by reason of the rapid reciprocating motion under heavy bearing pressures and because they are exposed to flying particles of sand and dust from the roadbed when the engine is in service and so they must be repaired.

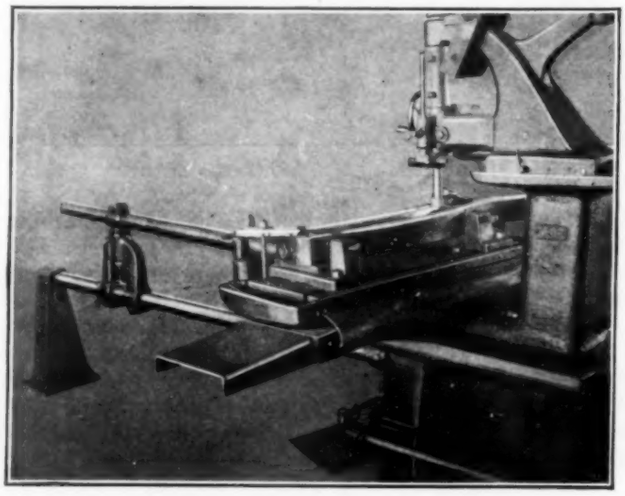


FIG. 26—GRINDING A LINK

The repairs involve, first the building up of the link block by the electric welding process and then re-grinding the new surface to a true arc, after which the inner surfaces of the links are reground to fit the blocks. A machine for grinding both blocks and links is shown in Figs. 25 and 26, in each case with a Walschaert link in place.

This machine is not unlike a toolroom surface grind-

ing machine. There is a bracket to carry a vertical wheel spindle that is located over the center of the table. Upon the reciprocating table there is mounted a secondary table so arranged as to swivel freely about a central stud. Rigidly attached to the upper table and extending at a right angle from it is the tubular radius rod *A*, passing through the swiveling fulcrum *B*, which is in turn fastened to the stationary rod *C*. The fulcrum is adjustable upon the stationary rod and the distance from it to the center of the stud upon which the table swivels, is the radius to which the machine will grind.

Repairs upon boilers at this shop are confined to flues, staybolts, mud-rings and minor parts around the fire-box. When new sheets are needed the boiler is lifted from the frames and sent to the boiler shop. Flues are welded in at the fire-box end with the electric arc, while the forward ends are rolled in on soft metal ferrules.

Tool Temperatures and the Cutting Resistance of Metals

At the 26th Annual Meeting of the American Society for Testing Materials, held at Atlantic City June 26 to 29, 1923, H. A. Schwartz and W. W. Slagle described an instrument for recording the changes in temperature of drills or other cutting tools in action. It is believed that the life of a good tool is a function of its working temperature, and hence that the temperatures under given cutting conditions in varying materials are an indication of their machineability or cutting hardness.

Data covering typical ferrous-alloys were given. Some relations between energy per cubic inch of metal removed, the temperature and the rate of the removal of metal were shown. These suggest the possibility of using a pyrometer in place of a tool dynamometer for determining the work done.

The tests were made with high-speed drills, ¾ in. in diameter and 3 in. long in the flutes, having two oil holes in the body between the flutes. These drills were supplied by the Cleveland Twist Drill Co. who also reground them to standard form whenever necessary.

The shanks of the drills were provided with flat lands to permit secure chucking in the fixed spindle of the testing machine. An iron-constantan couple was introduced into each hole, the junction being just inside the end of the hole and near the cutting edge. This arrangement made it necessary to hold the drill stationary and revolve the work. The fact that the two couples inserted in the oil holes read within a few degrees of each other whenever comparisons were made, showed that either indicated closely the temperature of the drill. It is quite probable, however, that the actual cutting or rubbing surface of each drill was a little hotter than the couple. This error was evidently small, however, as the couples were within a ½ in. of surface.

A Long Specimen Necessary

In order that the amount of penetration will be sufficient to allow the temperature to come to equilibrium, a very long specimen, many times longer than the drill, is required. This was accomplished by using a piece 24 in. long finished, to 1 in. in diameter, and set against the drill point through a ball bearing held in a steady-rest and meeting just in front of the drill point.

The procedure consisted in reading, or recording, the torque and thrust of the standard drill and following by the potentiometer its temperature, until the temperature became stationary.

Tests on each material were conducted at as many combinations of speed of 0.0025, 0.005, 0.01, 0.02 and 0.04 in various revolutions and with speeds of approximately 40, 80, 160, 320, 460, 640 and 760 r.p.m. as were within the hour capacity of the machine or the temperature range of the pyrometer.

The conclusion shows that there is a lack of relationship between cutting hardness and Brinell number. Malleable cast iron, Armco iron and mild or machinery steel, all have substantially similar Brinell hardness, yet the resistance in cutting varies widely. Experiments described lead to the conclusion that cutting resistance of various metals, even through a wide range of materials and feeds, could be shown quite accurately by the temperature developed by the cutting tool.

A cheap clamp for holding the drill and steadyrest could be mounted on the carriage of any lathe and render it available for comparisons of cutting hardness by this method. It is hoped to adopt this method of investigation to the turning operation where the need of rigidity under heavy cuts renders an application of a dynamometer very difficult.

In the past, tool loads have been regarded as relatively of slight significance in machine-shop operation. It was thought sufficient to meet increased loads by increased power of the machine and strength of the tool. These tests show that the increased loads find direct expression in increased tool temperature, and hence are of primary importance in determining tool life.

It may be assumed that cutting compounds act primarily by removing heat from the system. Such a removal of heat can be beneficial only if the maximum temperature of the cutting tool is reduced. If only the chips are cooled as they leave contact with the tool, little good can be accomplished.

A Disadvantage of the Monopoly Patent

In pointing out the development of the automatic spark control for automobile motors, one of the speakers at the S. A. E. convention, referred to several patents which had been issued for some particular features of the devices which were necessary for future developments. Unless, however, the various inventors get together in some sort of a mutual agreement, it is apparently impossible for the best results to be obtained.

If, as has been suggested on various occasions for many years, patents were granted with the understanding that they could be used by anyone on payment of royalty to the inventor, fragmental patents of this kind would help rather than hinder the final development of many useful devices. In the great majority of cases the inventor would probably receive far more than he does now and it would be possible for the most enterprising concerns to manufacture devices which embody all that was known to be best, without regard to the origin of the patents. This would be of special benefit to the users, who are not interested in the quarrels of patentees, but who wish the best devices possible for their use.

Book Reviews

The Story of Flying. Aircraft Year Book, 1923. Published by Aeronautical Chamber of Commerce of America, New York City. 396 pages, 6x9 inches.

This is by far the most ambitious effort which has yet been made to show in an interesting manner the advance which has been made in commercial aviation and in aeronautics generally. In addition to a large number of extremely interesting illustrations, the book contains much valuable information. There is, for example, a critical study of the services performed and the problems which had to be overcome by commercial aircraft in the United States. A detailed account is given of the achievements of the Air Mail Service, which has the enviable record of being over 95 per cent efficient for the year.

Several sections are devoted to the national airplane meet at Detroit, the Second Aero Congress, Safety in Flying, which points out the serious effect of the delay in securing a Federal Air Law; airship progress, including the Navy Dirigible ZR-1, the Zeppelin Reparation Ship ZR-3 and the Goodyear Army Semi-Rigid R-1.

Other sections show the technical progress in aircraft construction during the past year; a review of aeronautics throughout the world, the experiments in motorless flights; and aircraft and engine design. Separate sections are devoted to the commercial operation of aircraft and the Government. The latter includes both Army and Navy, as well as the Air Mail Service, the National Advisory Committee for Aeronautics, Bureau of Foreign and Domestic Commerce, and other Governmental activities along this line. The book is particularly valuable to all interested in the development of aviation. It shows very clearly the crying need for Federal control of all aviation, in order to prevent the many accidents due to the flying of unsafe aircraft, and in some cases, of unskilled pilots.

Germany's Capacity to Pay. By H. G. Moulton and C. E. McGuire. Three hundred and seventy-nine 6x9 pages. With charts, graphs and tables as illustrations. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York. Price, $2.50.

That Germany is unable to pay her war debt to the Allies unless her exports exceed her imports in both goods and service, is clearly and logically outlined and discussed in this book that has been prepared by Mr. Moulton and Mr. McGuire with the aid of the council and staff of the Institute of Economics.

That Germany owes nearly twice as much gold as there has been produced in the entire world since the discovery of America, and that her finances have been placed in a precarious condition by following the fallacy of trying to pay during the past four years when her trade balance was unfavorable, are pointed out by the authors.

Many of the popular fallacies of the situation are discussed. That Germany can pay by borrowing from the United States or by the sale of bonds in neutral markets are shown to be little short of ridiculous in that her debts would not be liquidated but merely shifted from one creditor to another. The disastrous results of going into the country to collect the debt are also reviewed.

Trade accounts, investment accounts, shipping accounts, banking and insurance accounts, and tourist accounts must all be considered in Germany's capacity to pay, assert the authors and proceed to show in detail the country's condition in all of these branches of revenues or expenditures. The amount spent by tourists is stressed as well as the fact that Germany cannot possibly pay a sum greater than that by which total exports exceed total imports.

There are eight chapters devoted to the following subjects: What paying foreign debts involves; Germany's international balance of accounts; what Germany has paid and how; German foreign trade requirements; the budgetary problem; the German monetary situation; how France met the indemnity of 1871; and international implications of the problem. There are also eight appendices.

The book shows much work on the part of the compilers and is a clearly analyzed study of a serious situation.

The Spanish Machinery Market

It seems that during the last few years American machinery manufacturers have paid but little attention to the possibilities offered again by the Spanish market, according to a European correspondent of the *American Machinist*. Up to the outbreak of the war, Spain imported all kinds of machinery and tools from the United States, the Spanish manufacturers being well aware of the superiority of the American makes.

Immediately after the close of the war German manufacturers made the greatest efforts to regain their foothold on the Spanish market, and likewise did Swiss, Swedish and English machinery makers. It should be borne in mind that during the war quite a number of new industries have sprung up in Spain and the demand for all kinds of modern tools is quite important at the present time. Of late, French machinery manufacturers are also paying closer attention to the Spanish requirements.

American manufacturers anxious to do business with Spain should send catalogs printed in Spanish. English catalogs are of little use. They should furthermore bear in mind that their prices should not be too high. Men in the trade stated that as a rule Swedish prices were about ten per cent lower than the American and Swiss prices. German products pay indeed higher import duty rates than other countries, but as the Spanish government authorities do not demand a certificate of origin, German machines and tools are being shipped quite frequently via a country with high rates of exchange, mostly via Holland.

In motors, for which there exists a considerable demand, especially for those of about 200 hp., Swiss manufacturers are leading more and more; German manufacturers, and lately also English machinery makers, are making almost incredibly easy terms of payment, extending credits up to even five years. Also in Diesel motors Swiss manufacturers are said to be leading. In some cases the Spanish importers have even paid prices for Swiss Diesel motors 25 per cent higher than those asked by German manufacturers.

The Spanish market requires especially machines and tools which are not too high in price, simply and strongly constructed and this particularly for the reason that the Spanish machinist in most cases is not capable of handling a complicated machine.

It Pays to Replace—

How a Shop Saved by Replacing Old Shop Equipment with New Equipment

By FRED H. KORFF
Factory Manager, Metal Stamping Co., Long Island City, N. Y.

This article won a $10 prize

WHILE working toward our production peak in 1922 it was found that the production curve while rising in all departments, showed a hesitancy in our miscellaneous parts japanning department.

The "drag" on our production was the japan baking equipment. It consisted of a battery of 12 gas-burning ovens 8 ft. high, 45 in. wide and 6 ft. deep, each being equipped with an indicating thermometer for the regulation of heat. Our operations were as follows: Parts were japanned by dipping and spraying and then placed on specially designed trucks, which, when filled, were placed in ovens for baking. The trucks were left in the ovens for one hour. Because of the heat, when they were taken out they had to cool a half-hour before the parts could be taken from them. The trucks, while being filled and while parts were cooling occupied needed floor space.

Our problem was solved by the installation of the semi-automatic, electrically driven and heated japan-baking conveyor-oven illustrated, designed by the writer and constructed after his own specifications at our plant. Six of the gas ovens were replaced by the conveyor-oven.

The framework is made of channel iron and the covered section of sheet steel. The insulation wall is of asbestos bricks 6 in. thick. The oven section is built in units of 4 ft. each, to permit of its being lengthened at any time if so desired. The heating units are Westinghouse Electric & Manufacturing Co. coils. This conveyor-oven overall is 46½ ft. long and 56 in. wide. It consists of a baking chamber 20 ft. long; a level horizontal loading section 10½ ft. long; a rise 4½ ft. long as the parts enter baking chamber; a drop 4½ ft. long at the unloading end; and a level horizontal unloading and cooling section 7 ft. long. The degree of heat in the baking chamber is controlled automatically by magnetically operated switches. All of this electrical equipment was specified by us and supplied by the Westinghouse Electric & Manufacturing Co. The parts travel on a double chain conveyor, the speed of which is controlled by a Reeves variable speed transmission.

CONVEYOR-OVEN, SHOWING UNLOADING END AND EXTERIOR

Our miscellaneous parts japan baking equipment at present consists of this conveyor-oven and six gas-

In the contest, which closed July 5, nine prizes were given for articles telling how a shop saved by replacing old shop equipments with new equipment. Additional articles will be printed in forthcoming issues.

burning ovens of the type described above. The figures given in the table show the saving actually effected in one month of operation this year over the corresponding month last year.

Our gross saving for the first year of operation will

ONE MONTH'S SAVINGS DUE TO NEW EQUIPMENT

	1922	1923
Number of parts japanned and baked	317,204	345,206
Number of men employed	20	13
Number of working hours per employe	204.5	209.1
Cost of fuel consumed		
Gas, 166,800 cu.ft. at $1.20 per M	$ 200.16	
Gas, 16,680 cu.ft. at $1.20 per M		$ 20.02
Electricity, 6,390 kw.-hr. at $0.02		127.80
Labor cost	1,840.50	1,223.24
Total cost of fuel and labor	2,040.66	1,371.06
Unit cost per part	0.00643	0.00397
Comparison: At the unit rate shown for 1922, parts japanned in 1923 would have cost		2,219.67
Cost with new equipment was (as above)		1,371.06
Actual saving for one month		$ 848.61

be no less than $8,000. The complete cost of the new electric conveyor-oven equipment, including cost of installation, was $2,600. This cost, by the saving effected, has been paid for by the first three full months of operation. As the life of the new equipment is at least fifteen years, the value of the investment can be readily appreciated.

Today increased efficiency is apparent throughout the miscellaneous parts japanning department. Our production curve there indicates no hesitancy. The operations of this department at present not only do not "drag" but can be accelerated at will without vibration. We show increased departmental output with costs reduced—it has paid us to "replace."

These articles won honorable mention

By F. E. Ervin
Foreman Machine Shop
Diamond Alkali Co., Painesville, Ohio

OUR plant is of such size and character that the maintenance department, especially the machine shop, assumes the proportions of a small manufacturing shop. There are used in the plant a very large number of gear reduction drives, transmitting from five to fifty horsepower; a turbine-driven pumping plant with capacity enough for a good-sized city; an engine room with over fifty engines, generators, blowers, high-pressure pumps, etc.; sixteen locomotives, locomotive crane, bridges, monorails; and literally hundreds of motors of every size.

All of this the company keeps in repair in its own shops, duplicate parts being made up as far as possible so as to cause the least delay for replacements. It is evident from the foregoing that there would be a large number of shafts, rods, valves, and valve stems to be gotten out. Formerly these parts were turned and finished to dimensions in the lathe, and no attempt was made to grind anything except the Corliss engine valves, which were ground dry in the lathe with a special motor-driven fixture, it often taking three days and nights to grind one set of eight valves. However, after long and patient effort the management was prevailed upon to install a Landis 12x96-in. plain grinding machine.

The result has been a complete overturn in our shop methods. Where formerly it took from fourteen to twenty days to overhaul a Corliss compressor-engine, we now do it in from nine to ten days. Where it used to take a day and a night to turn and finish a low-carbon or vanadium-steel drive shaft, we now have it turned, ground, drilled and keywayed ready for the press in 20 hr. Jobs that we formerly could trust to none but the most expert of our men, we now can give to the less reliable ones and their deficiencies are easily made up by the grinding machine. It is a surprising thing, too, that our most versatile grinding-machine operator never shone so brightly as a lathe man, either in accuracy or speed. But give him a definite size and he will produce it accurately and in a surprisingly short time on the grinding machine.

Where we used to be compelled to keep our lathes busy night and day, we now nearly always have a spare lathe which is most valuable in a maintenance shop, and at that, the grinding machine is by no means always busy although the volume of our work is increasing.

From a cost accountant's viewpoint, the grinding machine may not be earning its cost. But from the point of dollar-producing equipment kept going in the plant, it has earned its cost in the short year we have had it.

By William J. Fisher, Jr.
Foreman Machine Shop
Joseph Bancroft & Sons Co., Wilmington, Delaware

WE MAKE machines that require a heavy spider forced on to a steel shaft. This spider must be well fitted and has to be very tight, for, if it comes loose, it not only means the loss of the spider or shaft, but also the part that works in connection with it.

Formerly in forcing these spiders on we used a wooden frame, with a coarse pitch screw, having holes drilled in the head in which we put an iron bar to pull the spider into place. When the spider began to get tight, we used a longer bar with a rope tied to the end, as it stood up too far for a man to reach.

There was absolutely no way to tell how tight a fit we had, except by the number of men we had on the bar. It might be in place here to say that it was a rather dangerous proceeding, as the casting moved by jumps and a man had to be very careful when the pulling bar was overhead, as a small movement of the spider on the shaft meant a large one of the bar, which might strike a man on the head.

We now use a forcing machine with pump and gage complete, made by the Fairbanks Company, of New York, and the operator knowing what pressure he needs can watch the gage and get the desired results.

By Wm. Dossing
Reichel & Drews, Inc., Chicago, Ill.

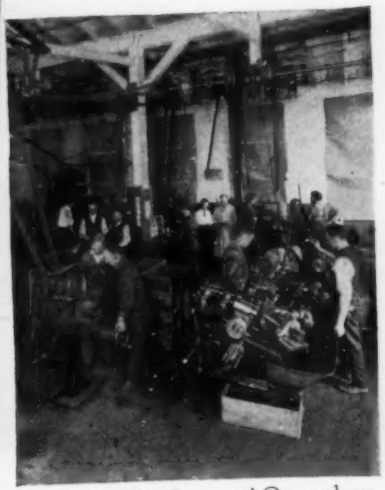
AMONG the articles we make are ring gears ¾ in. thick, 12⅓ in. outside diam. and 9 in. bore. These gears were formerly cut on a milling machine, the time being from 7 to 8 hr. each.

In December, 1921, our shop bought a Flather automatic gear cutting machine equipped with an arbor to hold six of the ring gears at a time. On this machine we now cut the gears in 2½ hours.

Where Machine Tools are Made

Gisholt Machine Company

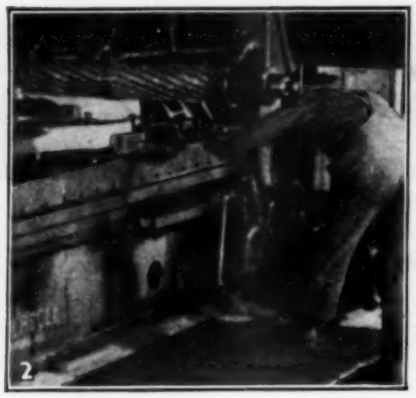
Turret Lathes on Production

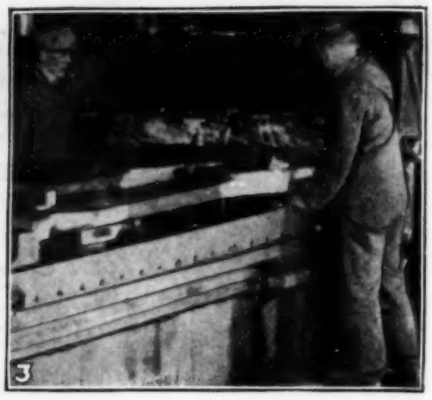


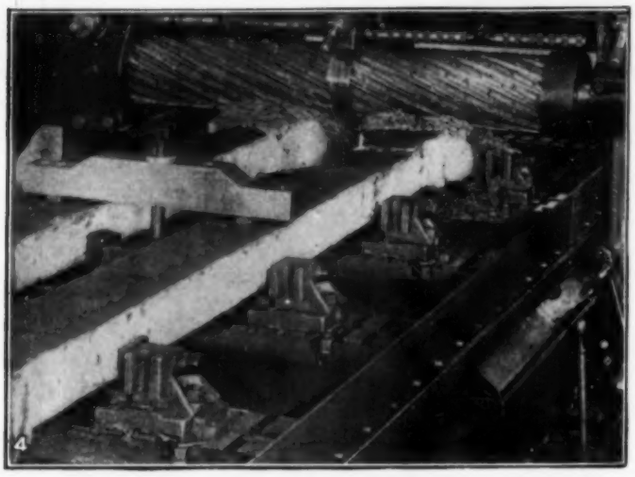
Training Customers' Operators

The Foundry

Machine Floor







Modern Methods of Machining Connecting and Side Rods

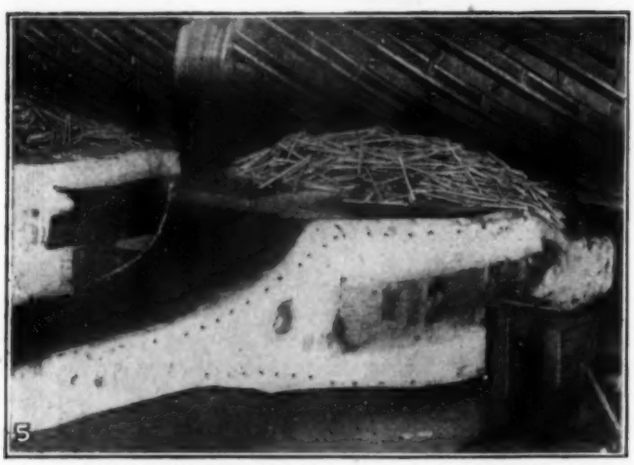
THESE illustrations show what are believed to be the latest methods of machining connecting and side rods for locomotives. They show the use of both types of Ingersoll milling machines including the special fixtures and tools which have been designed for this purpose. The captions which follow give a brief description of the methods and the results obtained.

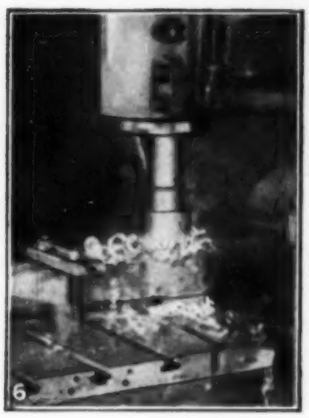
Fig. 1—Loading two heat treated chrome vanadium steel main side rods and making ready for slabbing the sides. These rods are laid out on the forging before coming to this machine.

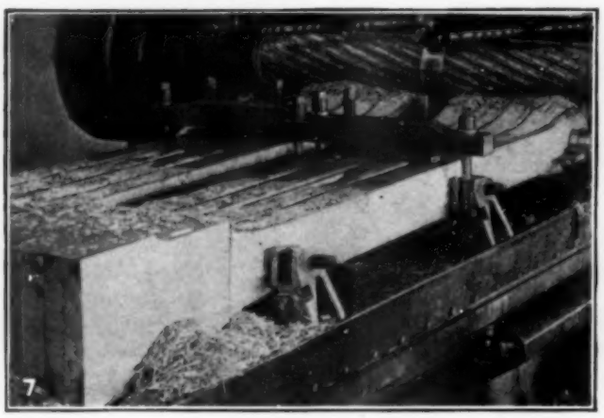
Fig. 2—Setting the two 9 x 24-in. Ingersoll helical inserted tooth cutters. These cutters are mounted on a single arbor and are driven by the single horizontal head through radial keys.

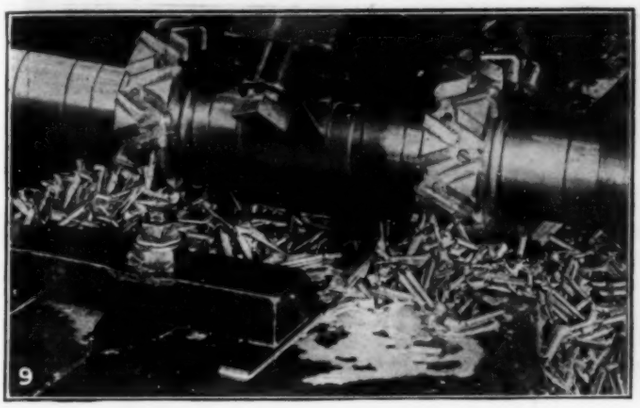
Fig. 3—Start of the cut which is $\frac{13}{16}$ in. deep × $30\frac{5}{8}$ in. wide. Table feed 3 in. per min. (limited by cutter speed). Cutter speed 33 ft. per min. (limited by scale). This feed produces an exceptionally fine finish.

Fig. 4—Slabbing the sides of two carbon steel main rods with two 9 x 24-in. Ingersoll cutters. Rods are held in fixtures which are universal for all locomotive rods. Cut is $\frac{13}{16}$ in. deep by $11\frac{1}{4}$ in. wide. Table feed 3 in. per min. Cutter speed 33 ft. per min. Removes 41 cu.in. of metal per min., requiring 59.5 hp. Floor to floor time 3 hr., 28 min., for slabbing both sides of two rods.









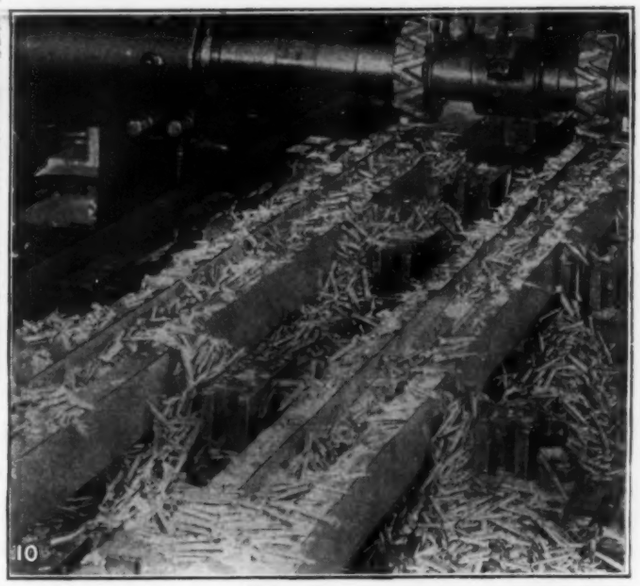


Fig. 5—Close-up of slabbing two rods on a 54 x 30-in. x 16-ft. horizontal spindle, inclined rail, milling machine, Note the method used in laying off work.

Fig. 6—Drilling 2½-in. hole in main rods. The rods are then mounted on arbors in sets of 8, before going to the edging operation. It is necessary to layout only the two outside rods.

Fig. 7—Edging 8 main rods, taking a cut ¼-in. deep, table feed 8½ in. per min., requiring 68 hp. Rods are held in Ingersoll universal rod fixtures. Cutters are 9 x 24 inches.

Fig. 8—Sinking channeling cutters to depth, 1⅝ inches.

Fig. 9—Channeling two 40 to 60 carbon steel rods on a 54 x 48-in. x 16-ft. machine, using a 10-in. cutter at 65½ ft. per min. cutting speed. Depth of cut 1⅝ in., width 3¼ in., table feed 4¾ in. per min., and consuming 86 horsepower.

Fig. 10—Channeling locomotive rod on 54 x 30-in. x 16-ft. milling machine, using patented staggered, inserted-tooth, channeling cutters.

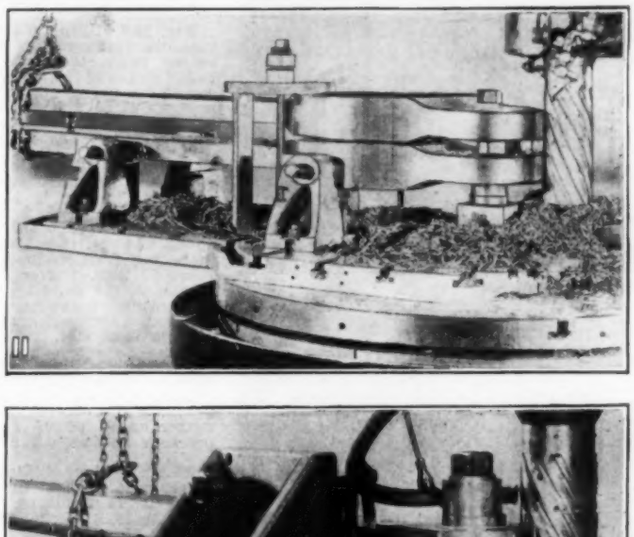
Fig. 11—Milling all the radii of two locomotive side rods on a special Ingersoll adjustable, rotary milling machine, using a 5 x 12-in. solid-shank, helical, inserted-tooth cutter, supported at lower end. The rods are held in special rod fixtures.

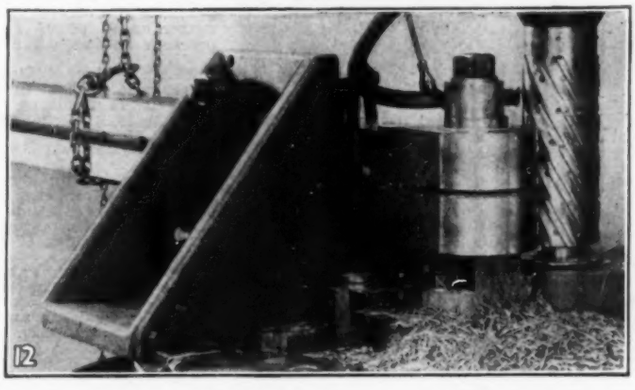
Fig. 12—Contour-milling the piston end of two heat treated, chrome vanadium steel main rods, using a 5 x 12-in. solid shank cutter, supported at the lower end. Table feed is 1½ in. per min., with a cutter speed of 35 ft. The cut is ⅝ in. deep and 10⅜ in. wide over all. Floor to floor time for two rods is 45 minutes.

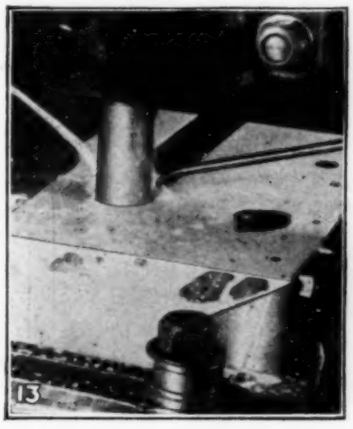
Fig. 13—Cutting the first side of a main rod-end.

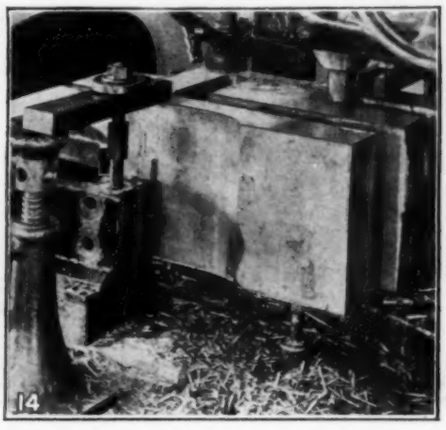
Fig. 14—Milling out the open or strap end of two carbon steel main rods on rotary milling machine. This is done with a 2½-in. solid, spiral cutter, supported at lower end. Floor to floor time for milling two rods 2 hr., 50 minutes.

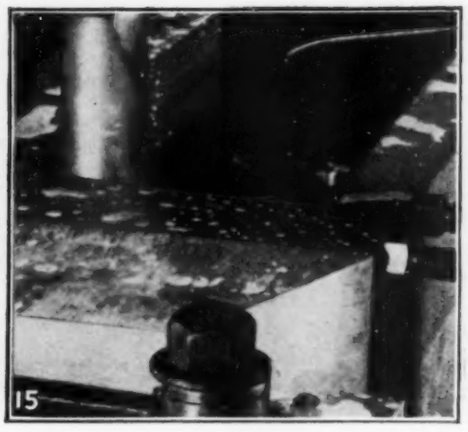
Fig. 15—Finishing the inside of the rod end.

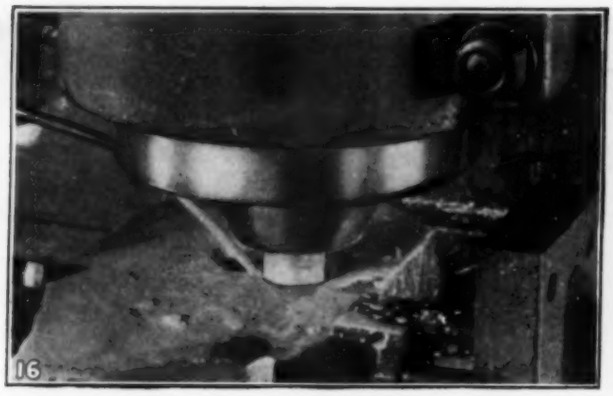


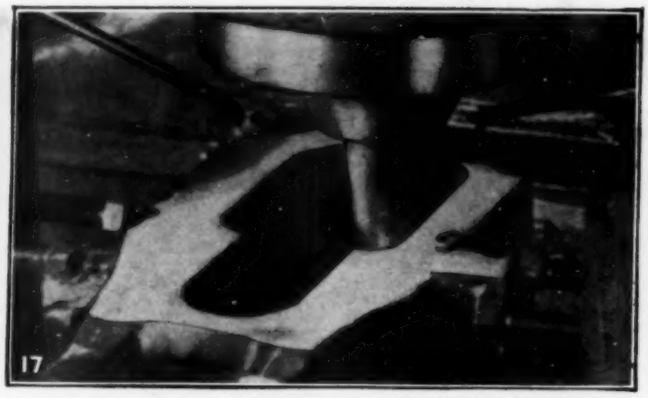


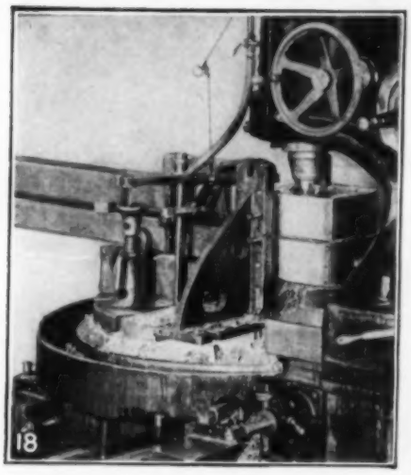












Modern Methods of Machining Connecting and Side Rods

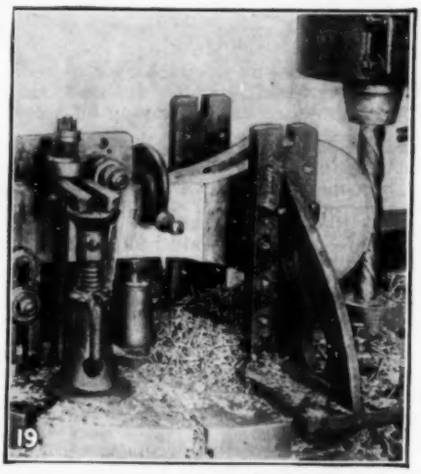
[CONTINUED]

Fig. 16—Milling out piston end. This operation starts from the 2½ in. hole drilled for the edging operation.

Fig. 17—Piston end completed.

Fig. 18—Milling piston end of two chrome-vanadium main rods with 2-in. solid spiral cutter, supported at lower end. Cut is 2 in. wide and 10⅜ in. deep. Feed for roughing cut, ¼ in. per min.; finishing cut, 1½ in. per min. Cutter speed, 50 ft. per min. Floor to floor time for two rods, finished ready for brasses, 4 hr., 30 min.

Fig. 19—Milling slot for tongue in chrome vanadium intermediate side rod using 2½ in. cutter. The cut is 11⅜ in. deep and 2½ in. wide. Table feed, ⅜ in. per min. for roughing, 1½ in. per min. for finishing. Cutter sped, 50 ft. per min., requiring 18 hp., including friction load. Floor to floor time, 1 hr. 20 min. After cutter mills full length of slot in the solid it is fed out at 1½ in. per min. taking finishing cut on one side of slot. Then fed in at same feed, finishing the other side of slot.



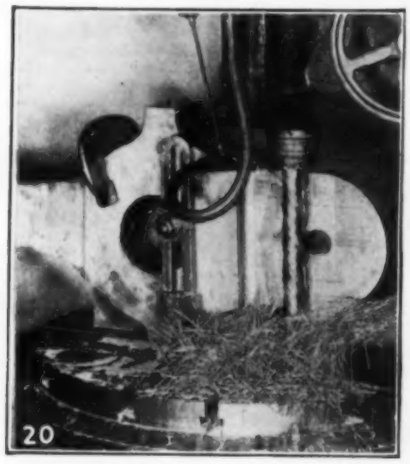
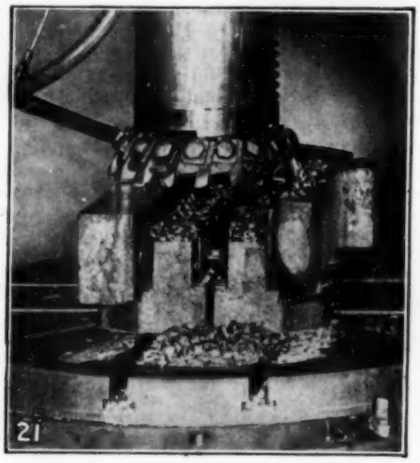


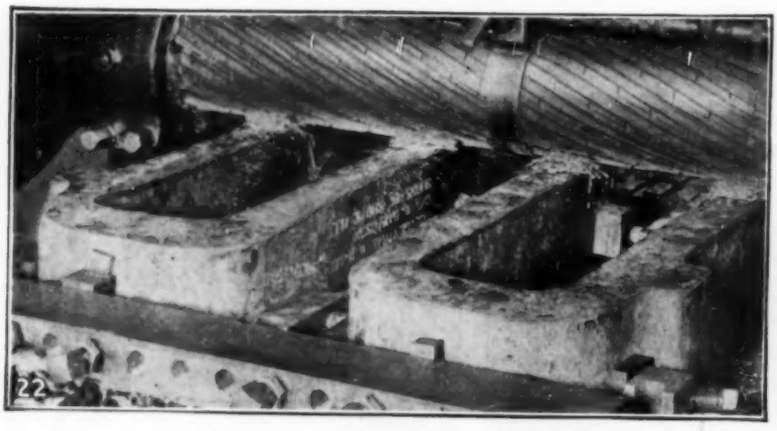
Fig. 20—Milling both sides of tongue of chrome vanadium side rod, using a 2⅜-in. cutter. Cut varies from ¼ in. to 1⅜ in. and is 7½ in. wide. Table feed is 2½ in. per min., cutter speed of 65 ft. Floor to floor time for four surfaces, 1 hr., 10 min.

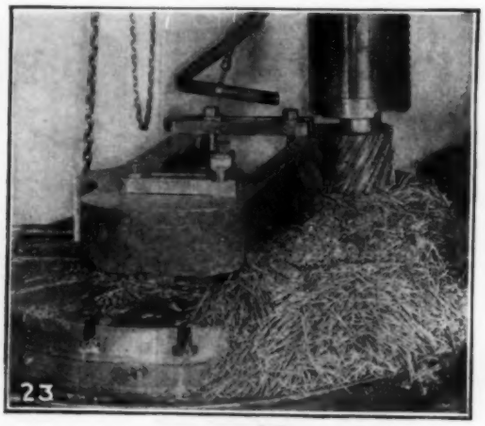
Fig. 21—Face-milling locomotive rod straps on rotary milling machine, using Ingersoll type "B" face-milling cutter.

Fig. 22—Slabbing two chrome vanadium straps using two 9x24-in. cutters. Cut is ⅜ in. deep. Width varies from 12 to 30 in. Table feed 4½ in. per min. Scale was very light, allowing increase in cutter speed. Table feed 4½ in. per min. Cutter speed 52 ft. per min. Floor to floor time 2 hr., 6 min., both sides of two straps.

Fig. 23—Milling outside of carbon main rod strap, except where the radius is under 6 in., using one 6x6-in. cutter. Cut varies from ⅜ to ½ in. in depth and is 5½ in. wide. Table feed, 1½ in. per min. Floor to floor time is 1 hr., 25 min.







The New Screw Thread Standard—II

By RALPH E. FLANDERS
General Manager, Jones & Lamson Machine Co.

Sellers' or U. S. S. Profile adopted for tooth form in A.E.S.C. report—Reasons for selecting the name American (National) for standard threads—Considerations affecting clearances and methods of gaging

CONTINUING the publication of the Screw Thread Report of the American Engineering Standards Committee, we next come to the section entitled:

II—FORM OF THREAD

The form of thread profile as specified herein, and known previously as the United States Standard or Sellers' profile, is adopted and shall hereafter be known as the American (National) Form of Thread.

1—Where Used.—The American (National) Form of Thread Profile shall be used wherever possible for screw-thread work.

2—Specifications.—The basic angle of thread (A) between the sides of the thread measured in an axial plane shall be 60 degrees. The line bisecting this 60-degree angle shall be perpendicular to the axis of the screw thread.

The basic width of flat at the root and crest of the thread form is found as follows:

$$F = \tfrac{1}{8} \times p, \text{ or } 0.125 \times p$$

The basic depth of the thread form is found as follows:

$$h = 0.649519 \times p = \frac{0.649519}{n}$$

where p = pitch in inches
n = number of threads per inch.

3—Illustration.—There are indicated in Fig. 5 the relations as specified herein for the American (National) Form of Thread for the minimum nut and maximum screw, Free Fit. These relations are further shown in Figs. 9, 10 and 11.

4—Clearance in Nut at Minor Diameter.—A clearance shall be provided at the minor diameter of the nut by removing the thread form at the crest by an amount between one-sixth and one-fourth of the basic thread depth.

5—Clearance in Nut at Major Diameter.—A clearance at the major diameter of the nut shall be provided by decreasing the depth of the truncation triangle any desired amount down to one-third of its theoretical value.

The parenthesized title for the standard—"American (National)"—will at once be noted. It is almost as objectionable as a hyphenated citizenship. It is unfortunate that it could not have been called "American" or "National" instead of both together.

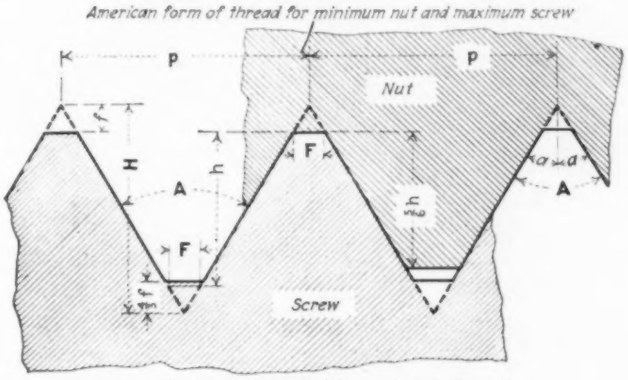
The situation developed from the considerations which originally led the Commission to adopt the term "National." It was feared that the term "American" would be prejudicial to its adoption by other nations; and it was believed that wide spread adoption would be facilitated by the ease of changing the title either to "International" (though that has been preempted by a metric standard) or to "Mexican National," Chinese National," etc. by the simple addition of the name of the country adopting it. On the other hand the rules of the American Engineering Standards call for the use of the term "American." As a compromise both words are used as given above. The precedent for this was established by the Commission itself when it approved the pipe thread standard already adopted by the A.E.S.C. as "American" and incorporated it bodily as the "National (American)" Standard.

In practice it will be allowable to call it by either name or by the combination of the two. Time will tell which name survives the test of usage.

The basic form of the new system is the old "U.S.S." In the actual form used there are certain radical departures, which make their first appearance in the provisions for clearance in paragraphs 4 and 5 given above. In the old U.S.S. standard it was assumed that a fit was desirable not only on the sides of the tooth, but at the crest and root as well. The new standard makes provision for definite clearances at the crest and root.

As a matter of fact practice has been moving in this direction for some time. First came the realization that the nut is not materially weakened if a tap drill larger than basic is used. Education on this point has reached the stage where a tap drill which allows only 75 per cent depth of engagement is accepted as satisfactory. Next came the adoption by the tap makers of standards which increase the outside diameters by 0.003 to 0.0035 in. over the basic, thus providing for an initial clearance on the outside diameter and allowing the cutting points to wear somewhat without cutting threads which reject a basic plug gage. It has also been common to turn the outside diameter of the screw a little below basic before threading.

All the above procedures are "good practice." They assure that the fit shall take place on the sides of the



No allowance is shown. This condition exists in Class 2 and Class 3, specified herein, where both the minimum nut and maximum screw are basic in pitch diameter.

FIG. 5—FORM OF THREAD FOR MINIMUM NUT AND MAXIMUM SCREW

thread only, where it is wanted, and not at crest or root where it is not merely useless but harmful as well, as tending to conceal poor workmanship on the sides of the thread. In all this it is assumed that screw threads are used to hold parts together or apart in direct tension or compression only, and that they are never to be used as dowel pins, for lateral control. This is important. No self-respecting mechanic or designer will permit a screw to be used as a dowel pin where close lateral control is necessary.

There is one expedient to obtain root-and-crest clearance which has been employed by some important firms that is quite objectionable. This is the carrying of the crests of the threads in dies and chasers to points sharper than the basic form, so that the resulting thread on the screw, when made to basic pitch diameter, has a minor diameter considerably below basic. This is bad because it weakens the screw at the minor

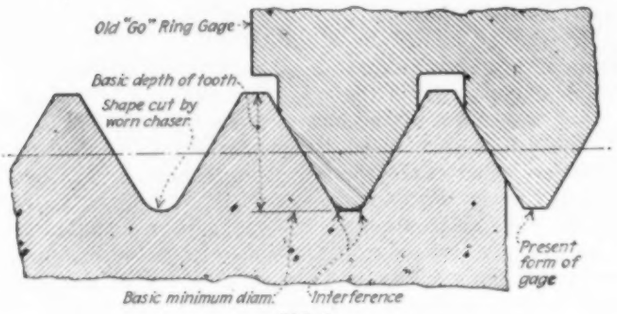


FIG. 6

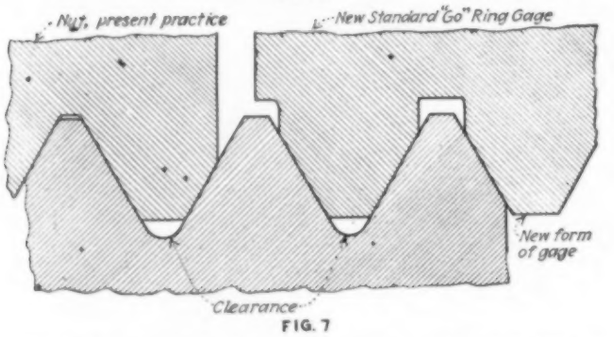


FIG. 7

FIGS. 6 AND 7—DIAGRAMS TO SHOW DIFFERENCES BETWEEN OLD AND NEW RING GAGES

diameter where it is weakest anyway; and the screw is usually weaker than the nut at that, in any ordinary design of threaded parts.

In reality this harmful practice has arisen not so much to obtain clearance for the crests of the thread in the nut, as to get corresponding clearance for the threads of the *ring gage* with which the screw, bolt or stud is tested. Gage makers have hesitated to make the minor diameter of a ring gage larger than basic in spite of the almost universal use of oversize tap drills, because there was no minimum limit set for that dimension short of the basic minor diameter—so to basic minor diameter have they been made.

Effect of Wear at Crest of Chaser

The writer's work includes the manufacture of self-opening die holders and chasers for the same, on a large production basis. One of the most frequent complaints sent in by customers is that a thread cut to fit a basic ring gage is loose in a nut or tapped hole which has been tested as being a tight fit with a basic threaded plug gage. The customer assumes that the chasers have the wrong shape in some way. The real trouble is simple. The ring gage has sharp corners at the crests of the teeth. The chasers originally have sharp corners at the crests, but they wear somewhat with use. When they commence to round over the fillets thus produced at the roots of the screw thread interfere with the sharp crests of the ring gage, which thus rejects the work. The operator thereupon sets the die to a smaller pitch diameter until the piece enters the ring gage. Then, of course, the screw is loose in a standard nut, because the fillets do not interfere with the crests of the thread of the nut or tapped hole, since in that case the minor diameter was formed by an oversize tap drill, larger than basic. The ring gage thus rejects work which is perfection so far as actual practice is concerned. All this trouble, as shown in Figs. 6 and 7 is avoidable by the setting of a maximum minor diameter for the screw very considerably larger than basic, by an amount that will be given later in connection with the tolerance tables. One of the first steps that should be taken in the adoption of the new standard is that of the oversize minimum tap drills for the tapped holes, and the oversize minimum minor diameter for standard "Go" ring gages, to be furnished by all responsible gage manufacturers. The charts used in optical measurement already take care of this situation.

Value of Crest and Root Clearances

This definite provision of clearance at the minor diameter, and permission for clearance at the major diameter, are of additional value in allowing the use of threading tools (taps, dies, chasers, lathe tools, etc.) with rounded crests, which give a more durable cutting edge than the sharp corners of the basic U.S.S. form. The limits of this permissible rounding will be given later under the section of the report devoted to "Tolerances."

While we are on this matter of crest and root clearances, attention should be called to another harmful practice occasionally met with in the electrical industry. There is a class of work in connection with the terminals for large leads in certain apparatus where it is required to make electrical contact on a thread for the carrying of a heavy current. To reduce the resistance of the contact and avoid heating and excessive corrosion a good fit is necessary. In their desire to obtain the largest conducting surface possible some electrical engineers have been led to specify contact on the flats at the crest and root as well as on the flanks of the teeth. This is extremely dangerous, as with any ordinary means of gaging the chances are more than even that the contact will be on the major or minor diameter only, and not at all on the flanks. In the long run a larger contact will be obtained more surely by concentrating on a high-grade fit on the flanks only.

All cases of this sort should be inspected by optical projection. It is the writer's opinion that one good look at a thread contour magnified 200 times is worth an hour's fumbling with the miscellaneous collection of gages necessary to tell the whole story of the accuracy of a thread in contour, pitch diameter, lead, concentricity, etc.

The relation of this new thread form with a permissible rounded root to international standardization will be discussed in a later chapter.

The next installment deals with thread series.

The Methods and Principles of Frank B. Gilbreth, Inc.—VI

BY K. H. CONDIT
Editor, *American Machinist*

The toolroom and its place in the production scheme—Duties of the toolkeeper — Tool classification, storage and maintenance — The Taylor tool stand and its use

IN A previous article it was stated that one of the three prerequisites to maximum production was an adequate supply of material ready for the worker's hands. It is equally important to make sure that he has the right tools for the job and that he does not have to wait for them when he is ready to use them. In a shop of any size, it is quite impossible to keep track of tools without a well arranged and systematically kept tool room. The Gilbreths, therefore, make the tool room one of the first points of attack in reorganizing a machine shop.

Before going into details of tool room construction and arrangement, it may be well to set down a few general rules applying to tools which the Gilbreth engineers have developed by experience. The first question that naturally presents itself is, what is a tool? Mr. Gilbreth says that anything which is used more than once is a tool. A captious critic could probably discover exceptions to this definition, but it seems to cover the majority of cases. Under its terms, hammers, step-ladders, lathes, or shop trucks, fall in the same category.

The first rule laid down with regard to tools is that one man must be responsible for keeping them in repair. In some unusual cases, it may happen that he will also make the repairs, but it is far better to have some one alse make them on his order. If the man responsible for keeping tools in repair has to do the work himself, it is only natural that he will procrastinate, putting off the more difficult jobs until he has more time, with the inevitable result that such jobs are often not completed when they are needed.

The tools used in a machine shop may be divided into four different classifications. In the first class, we may put the tools used by one man only. Such tools should stay with their user, and may be kept in any way which seems best to meet the local requirements, as, for instance, a tool box, a locked drawer or a tool cabinet.

The second class will include those tools used at one machine only, such as the special socket wrenches furnished as regular equipment with a lathe or a milling machine. These tools should stay at the machine.

In the third class are placed tools used by more than one man, or at more than one machine. They should go to the tool room when not immediately needed. The final classification will take in certain tools which meet the requirements of class 3, but are generally not kept in a tool room, such as step-ladders, shop trucks, tote boxes, etc.

Arrangement must be made for periodic inspection of all tools of all four classes by the man responsible for their good condition, either by sending the tools to the tool room or by having the man responsible go to where the tools are kept.

Most engineers are familiar with the Taylor standardized tool storage racks. They were used by Mr. Gilbreth until he evolved his present improved design.

19

20

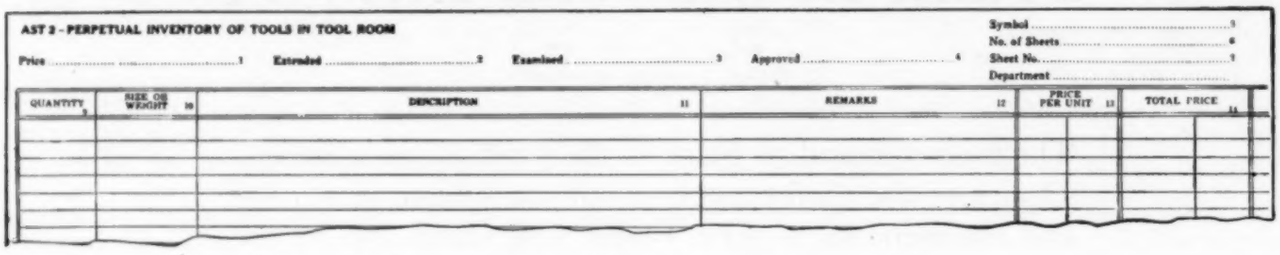
FIGS. 19 AND 20—SAMPLES OF THE CONTENTS OF FORGOTTEN BENCH DRAWERS

The Taylor rack is made of wood and consists of a box 17 in. deep divided into eight compartments 24½ x 24½ in. The rack is twice as high as it is wide, thus giving an arrangement four compartments high and two wide. The back of the rack is closed by 3-in. slats spaced 3 in. apart, so that a rack similar in design, but with its slats opposite the spaces in the first rack can be backed up to it and thus give closed backs to both racks.

The principal objection to this design of storage rack is that it is heavy and cumbersome. In addition, it is so high that if any tools or parts are placed on top, a step-ladder is required to reach them. It may even be too high for some tool rooms. The natural question at this point is, what is the objection to heavy and cumbrous tool bins? The answer is that the first location chosen for the tool room is very seldom the final one. To allow for this human failing, Mr. Gilbreth makes his tool storage rack of the same dimensions but only one tier high instead of four, and then piles these racks one on top of another to the required height. By making them smaller, he is also able to use lighter wood, and thus to save weight in the total assembly. The bins are all standardized and are easily portable. His usual practice is to place these units three high, and use enough of them so that only the lower two in each rack are needed for the tools brought in as a result of the first collection order.

It is a strange fact that, no matter how drastic the order issued for all tools to be turned in, and no matter how sure every man in the shop is that they all have been turned in, there are usually enough discovered later to fill the top tier of the rack. An idea of what may be expected to turn up in forgotten bench drawers may be gained from Figs. 19 and 20, photographs taken in different shops but showing practically the same state of affairs.

Assuming that all tools have finally been collected, an inventory is taken which will show the right number of some kinds, too many of others and too few of still others. It will also show up some of the wrong kinds that should be discarded. A useful form for taking the perpetual tool inventory is shown in Fig. 21. A decision must be made by those in authority as to the proper number of each kind of tool to be kept



AST 2 - PERPETUAL INVENTORY OF TOOLS IN TOOL ROOM

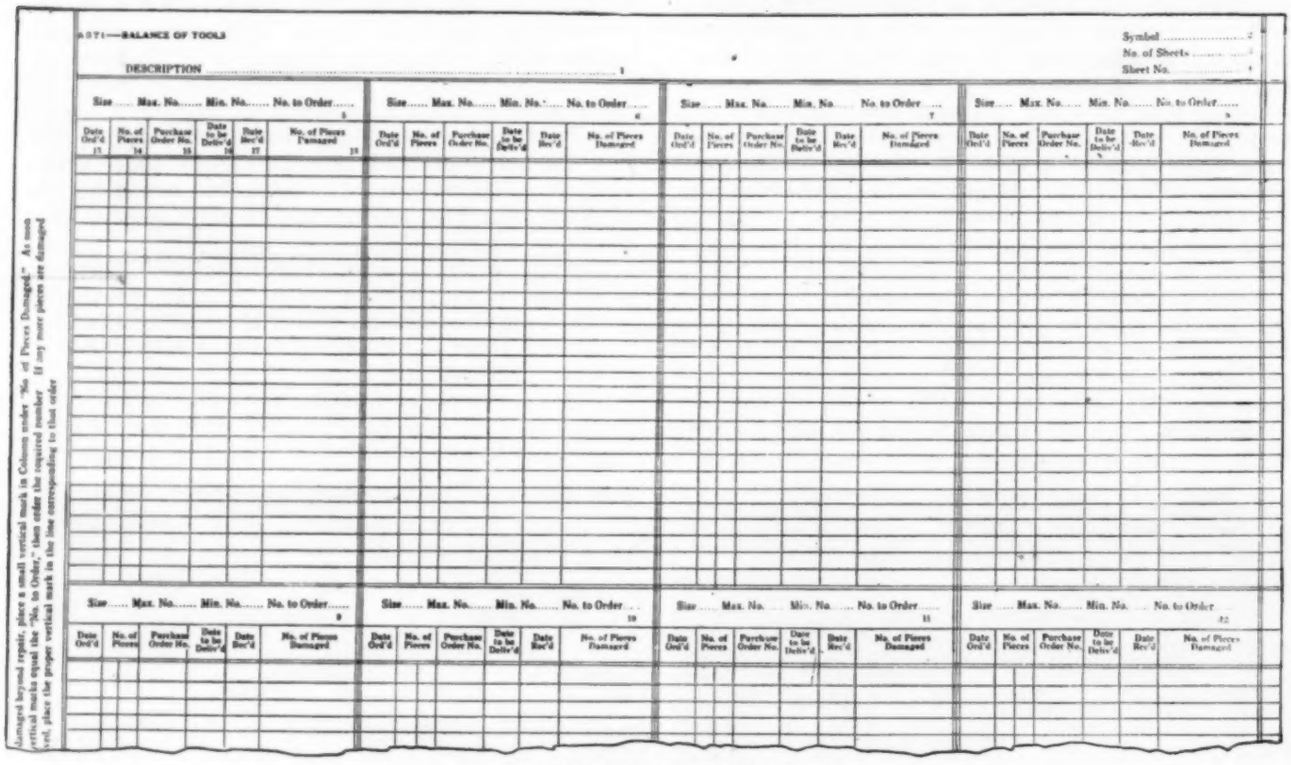
Price ..... 1 Extended ..... 2 Examined ..... 3 Approved 4

Symbol 5
No. of Sheets 6
Sheet No. 7
Department .....

QUANTITY 8	SIZE OR WEIGHT 10	DESCRIPTION 11	REMARKS 12	PRICE PER UNIT 13	TOTAL PRICE 14

This stock of Tools to be kept Permanently on hand, in Tool Room, and the quantity of each, according to list.
Strictly adhered to. No changes to be made without proper written authority.

FIG. 21—FORM FOR TAKING AND KEEPING PERPETUAL TOOL INVENTORY



AST1—BALANCE OF TOOLS

DESCRIPTION 1

Symbol 2
No. of Sheets 3
Sheet No. 4

Size ..... Max. No. ..... Min. No. ..... No. to Order 5

Date Ord'd 15	No. of Pieces 14	Purchase Order No. 15	Date to be Deliv'd 16	Date Rec'd 17	No. of Pieces Damaged 18

Size ..... Max. No. ..... Min. No. ..... No. to Order 6

Date Ord'd	No. of Pieces	Purchase Order No.	Date to be Deliv'd	Date Rec'd	No. of Pieces Damaged

Size ..... Max. No. ..... Min. No. ..... No. to Order 7

Date Ord'd	No. of Pieces	Purchase Order No.	Date to be Deliv'd	Date Rec'd	No. of Pieces Damaged

Size ..... Max. No. ..... Min. No. ..... No. to Order 8

Date Ord'd	No. of Pieces	Purchase Order No.	Date to be Deliv'd	Date Rec'd	No. of Pieces Damaged

Size ..... Max. No. ..... Min. No. ..... No. to Order 9

Date Ord'd	No. of Pieces	Purchase Order No.	Date to be Deliv'd	Date Rec'd	No. of Pieces Damaged

Size ..... Max. No. ..... Min. No. ..... No. to Order 10

Date Ord'd	No. of Pieces	Purchase Order No.	Date to be Deliv'd	Date Rec'd	No. of Pieces Damaged

Size ..... Max. No. ..... Min. No. ..... No. to Order 11

Date Ord'd	No. of Pieces	Purchase Order No.	Date to be Deliv'd	Date Rec'd	No. of Pieces Damaged

Size ..... Max. No. ..... Min. No. ..... No. to Order 12

Date Ord'd	No. of Pieces	Purchase Order No.	Date to be Deliv'd	Date Rec'd	No. of Pieces Damaged

Damaged beyond repair, place a small vertical mark in Column under "No. of Pieces Damaged." As soon vertical marks equal the "No. to Order," then order the required number. If any more pieces are damaged ved, place the proper vertical mark in the line corresponding to that order

FIG. 22—BALANCE OF TOOLS FORM

AST-3—LIST OF TOOLS CHARGED TO WORKMAN

Each Workman is provided with a Locker or Closet in which to lock up the Tools charged to him. Other Tools needed can be obtained from the Tool Room on leaving a Numbered Check as a receipt. All Tools out on Check must be returned immediately after they have been used.

All damage or loss of Tools will be charged to owner of Check held as receipt unless such damage or loss is proved to have been unavoidable.

PIECES 1	NAME 2	SIZE 3	TOOL SYMBOL 4	PRICE 5
	BRUSH			
	CENTRE PUNCH			
	CHISELS			
	CALIPERS			
	CHECKS No.			
	DRIFT			
	FILES			
	FILE CARD			
	FILE HANDLE			
	HAMMER			
	KEY No.			
	LOCK No.			
	OIL CAN			
	SCREW DRIVER			
	SCRIBER			
	VISE CLAMPS			
	WRENCHES			

I have received the Tools listed above and agree to be held responsible for the care and safe keeping of the same.

Signed 6

Month	Day	Year
		9

Workman's No. 7

Locker No. 8

FIG. 23—FORM FOR LISTING TOOLS CHARGED TO WORKMAN

on hand ready for use. This number is entered in column 9 of Fig. 21. The headings on the other columns are self-explanatory. Note that this form conforms to Gilbreth standards, in that the directions are placed in the binding margin and the waste space

SM-17

TOOL LIST FOR

OPERATION SYMBOL

MACHINE NO. _____ DRAW. NOS. _____

TOOLS CALLED FOR ON THIS TOOL LIST MUST BE ISSUED IN A TOTE BOX. THE LIST SHOULD BE PLACED IN THE TAG POCKET ON THE BOX AND ACCOMPANY THE TOOLS TO AND FROM THE MACHINE.

CLASS	NO.	SYMBOL	SIZE

CHECKS REQ'D	MAN'S NO.	HOUR	MONTH	DAY	19	SIGNED

WHEN THE TOOL LIST IS NOT CORRECT THE GANG BOSS MUST AT ONCE REPORT THE ERROR TO THE MAN WHO SIGNED THIS LIST

FIG. 24—TOOL LIST FOR A MACHINE

usually above the table lines is reduced to a minimum.

When once the proper number of each kind of tool has been set and entered on the perpetual inventory form, it becomes the duty of the tool keeper to make the tools conform to the inventory. For this purpose, the balance of tools form shown in Fig. 22 is used. Examination of the explanatory note on the margin of this form will show how it is to be used. It may seem a little confusing that column 18 is filled out before any one of columns 13 to 17, but in practice this appears to work out without difficulty.

The tool list shown in Fig. 23 for keeping track of tools charged to a workman may be modified, as shown in Fig. 24, to serve as a tool list for any particular machine. In the latter form, it is placed in the tag pocket on the end of the tote box, in which the tools listed on it are placed.

The inventory forms are bound in inexpensive, lightweight covers, which can be had for about 30 cents, and are much lighter and easier to handle than

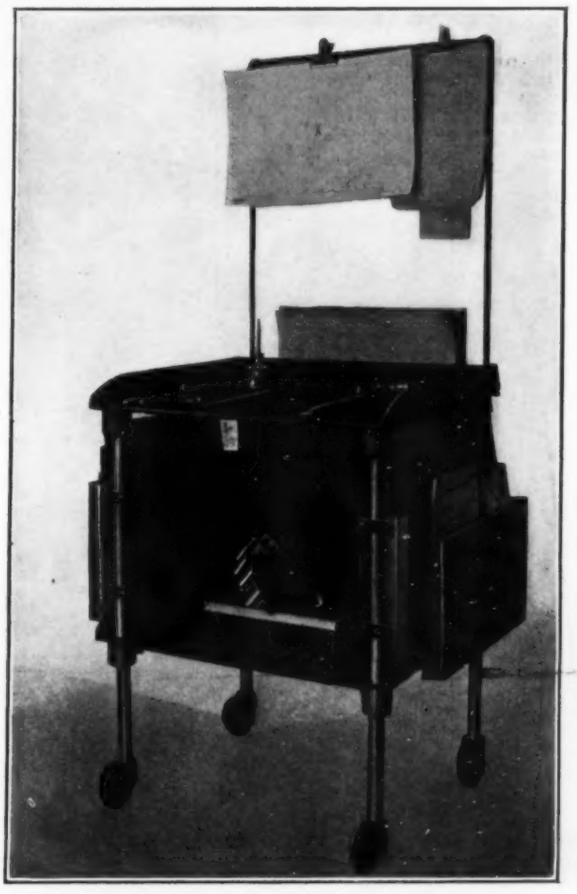
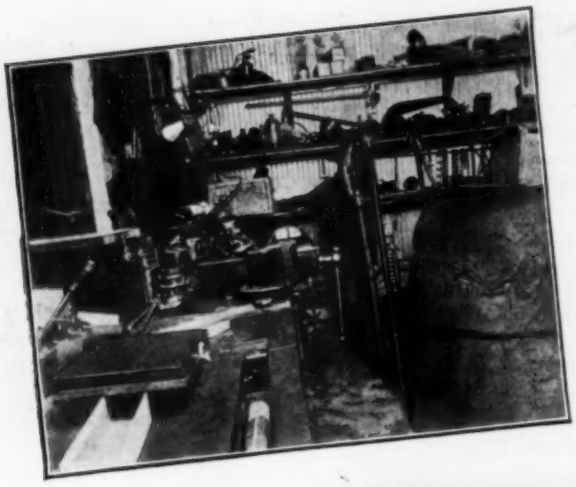


FIG. 25—TAYLOR TOOL STAND

the elaborate cloth covered board cover sometimes seen. The books of inventory forms are stood wrong side up on the tool keeper's desk or table. The name of each is printed right side up. The reason for this odd procedure will be clear if you will stand a book upside down in front of you, put one hand on top of it, and bring that hand toward you. As the book falls open, it will be in the right position to be read, and you have only made one motion with your hand instead of three or four.

Tools should always be ready for one job ahead,



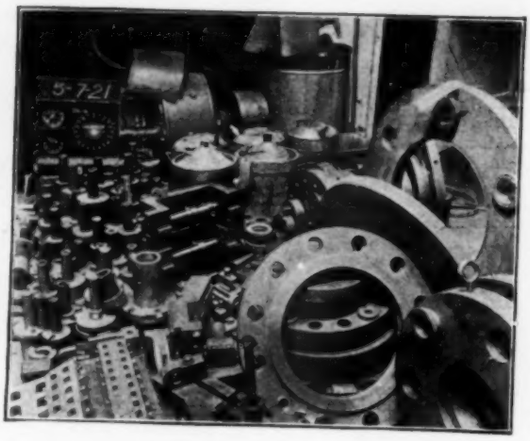
(ABOVE) A HORRIBLE EXAMPLE OF TOOLROOM DISORGANIZATION.

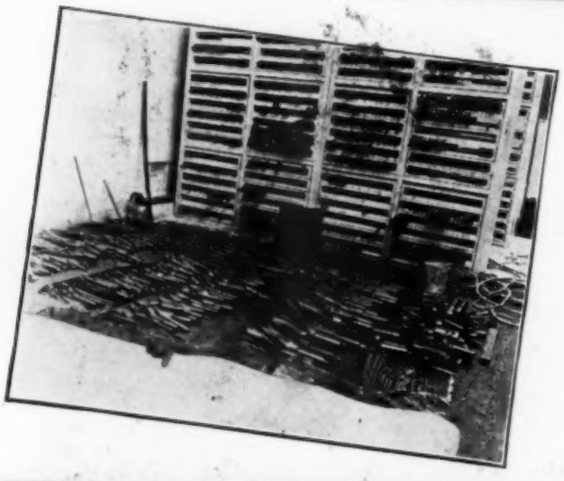
(BELOW) TRANSITION PERIOD, SHOWING TOOLS LAID OUT ON THE FLOOR WAITING TO BE CLASSIFIED AND ASSIGNED SPACE IN THE RACKS.

(ABOVE) ANOTHER HORRIBLE EXAMPLE.

(LEFT) A COLLECTION OF TOOLS—THE FIRST STEP IN REORGANIZATION.

(BELOW) DRILLS AND CUTTERS TEMPORARILY ON WOODEN SLIDES IN STEEL RACKS.





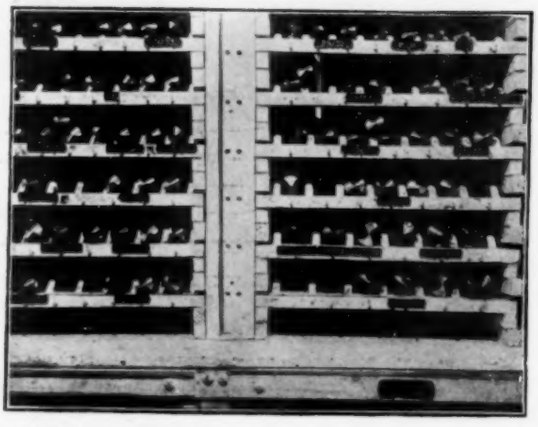
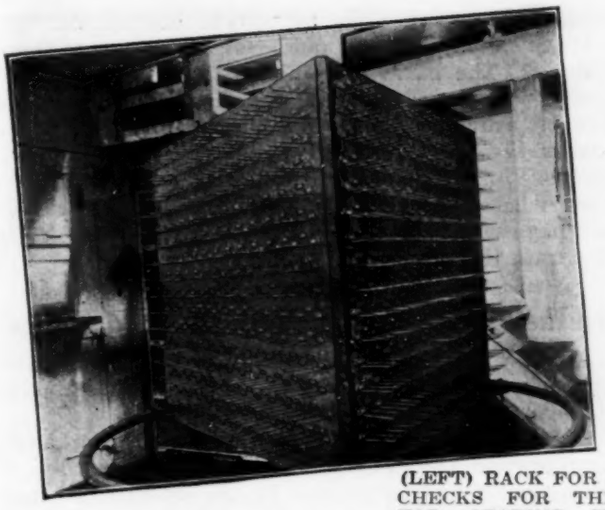
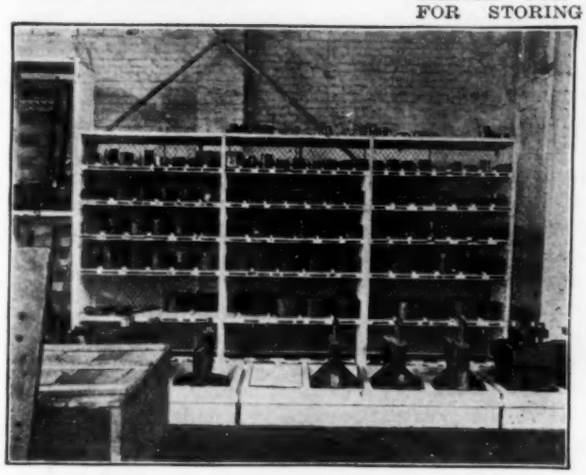
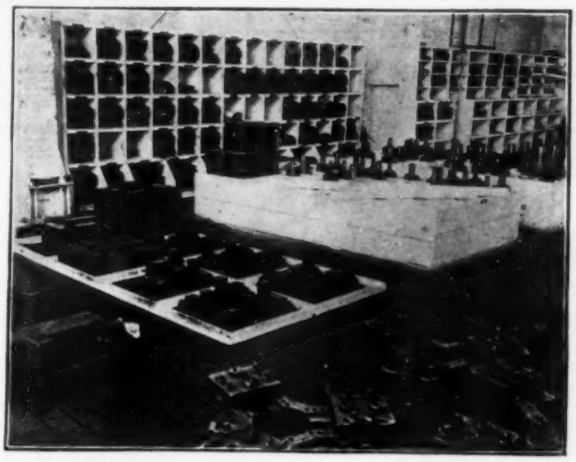


FIG. 26—TOOLROOMS BEFORE AND DURING TREATMENT

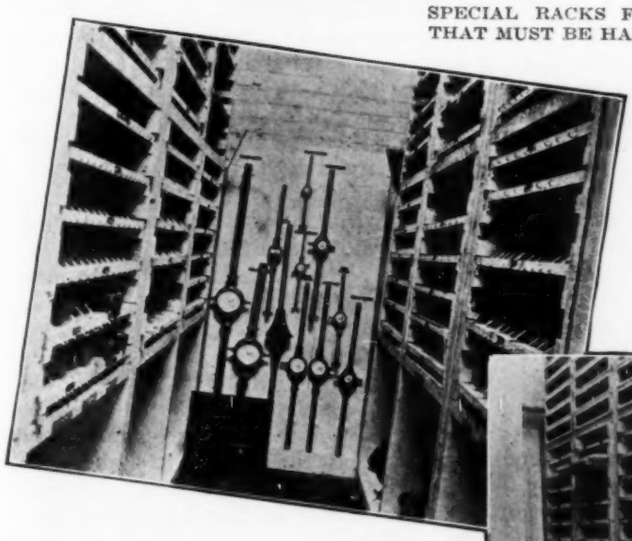


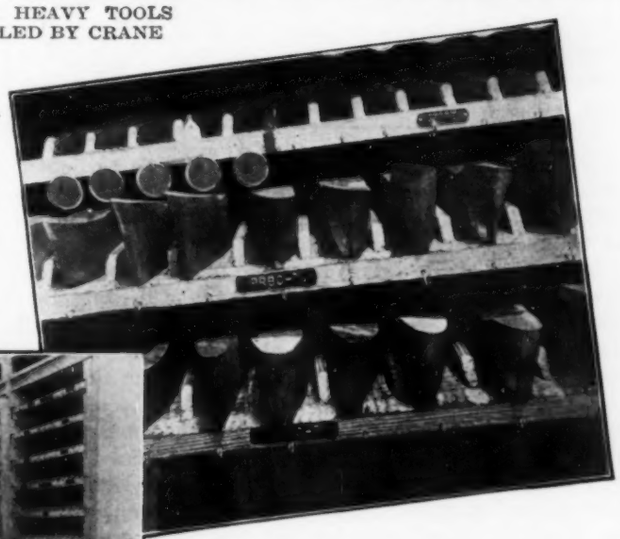
(LEFT) RACK FOR KEEPING WORKMEN'S CHECKS FOR THEM. (RIGHT) RACK FOR STORING UNASSIGNED CHECKS

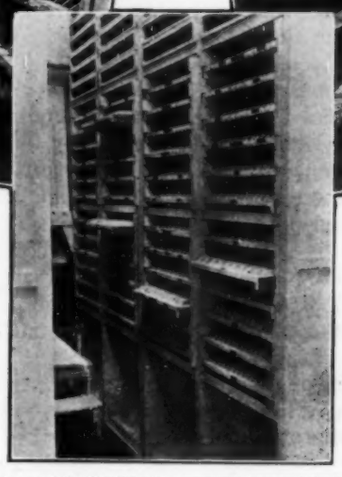




SPECIAL RACKS FOR HEAVY TOOLS THAT MUST BE HANDLED BY CRANE







(ABOVE) A FINISHED JOB SHOWING TOOLS ON HORIZONTAL SLIDES AND LONG-HANDLED TOOLS HANGING UP.

(ABOVE) TOOLS ARRANGED SO THAT CUTTING EDGES CAN BE INSPECTED, (LEFT) HORIZONTAL SLIDES READY TO BE FILLED.

FIG. 27—TOOLROOMS AFTER TREATMENT

depending, of course, on the length of the job. In some cases, it may be advisable to have them at the workman's bench, in others it will be sufficient to have them in their tote boxes on the file rack in the tool room ready to be drawn.

A standard Taylor tool bench or tool stand is shown in Fig. 25 to illustrate the disposition of the various forms already mentioned. On the rack at the back of the stand the workman clips the drawing, instruction sheet and tool list which he wants to study. They may be those for his test job, or if he has that well in hand, for the next job. In the latter case, he uses

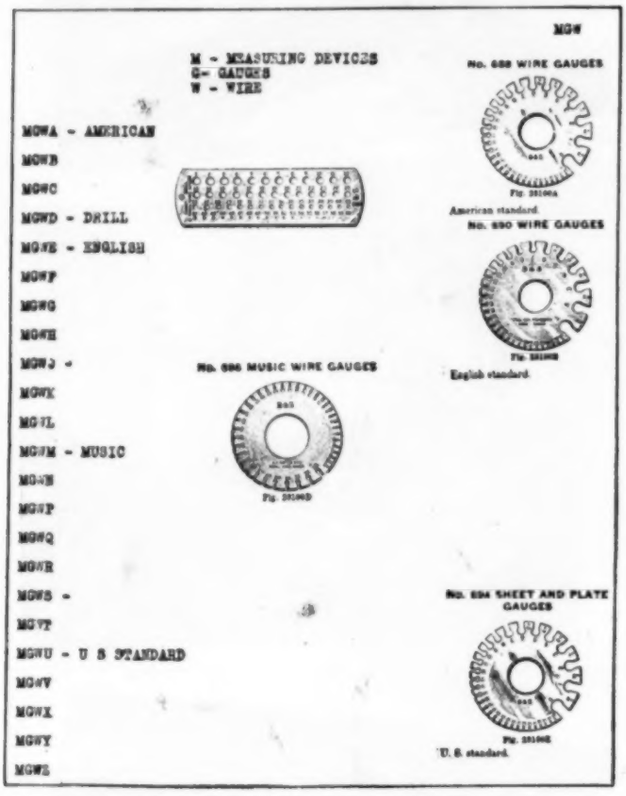


FIG. 28—A PAGE FROM THE GILBRETH TOOL CLASSIFICATION BOOK

his resting time to study the next job, so that he will be ready for it.

In the can at the left side of the bench, instructions, drawings and tool lists for the jobs ahead of him are placed. They stick up above the edge of the can, so that the foreman can see at a glance whether this particular man has work ahead of him. As he finishes a job, the sheets applying to that job are placed in the can at the back of the bench. As the inspector inspects the job, he removes the sheets from the rear can and puts them in the right-hand can. If the foreman spots too many sheets in the rear can, he knows at once that the inspector has not been on his job, and acts accordingly. The right-hand can is finally emptied by the blueprint boy.

So much for the principles on which tool room system is based. The illustrations grouped in Figs. 26 and 27 show various tool rooms before and after treatment. Note that in the rearranged tool room edged tools are always placed with their edges out, so that anyone making an inspection can tell at once whether the tools are in proper condition for use or not.

Classification of tools as worked out by Mr. Gilbreth is a study in itself and beyond the scope of these articles. The basic principle is that tools used for similar purposes, such as mallets, hammers and sledges, are classified so that they reside in the same part of the tool room. As may be gathered from the marking on the racks in the tool room illustrations the symbols used are mnemonic. In Fig. 28 is shown one page from the Gilbreth tool classification list to illustrate the principle involved.

Industrial Accidents in the United States

A report on industrial accidents in the United States has recently been issued by the United States Bureau of Labor Statistics as Bulletin No. 339.

The development of the vast system of workmen's compensation throughout the country has resulted in the assembly and publication by the several compensation jurisdictions of a great volume of statistical data. About one-half of the report deals with these data in an attempt to show what can be gathered toward a presentation of the accident situation on a national scale. So far as possible the record has been arranged on a uniform classification of industries, cause of injury, nature of injury and location of injury. Unfortunately lack of information regarding the amount of exposure in the various industries renders this body of information less significant than it otherwise would be.

There are two purposes to be served by a study of accidents. First, their prevention so far as this is possible and second, the adequate compensation of those accidents which can not be prevented. Five things are necessary to know regarding accidents if their study is to be of the greatest service in accident prevention, viz.: The number of accidents, the industries in which they occur, the causes, the amount of exposure to hazard, and the severity of the accidents.

In this study information was obtained from 42 states concerning the number of fatal and non-fatal accidents; 22 states reported accidents by industries; 18 states reported causes of injury, 12 nature of injury, and 11 location of injury; only two states showed the amount of exposure, and only three reported the severity.

There was a reduction in fatalities in 1921 over those occurring in 1918. The number of fatal accidents recorded by the states in 1918 was 12,531 while in 1921 there were but 9,394 reported. The former year, however, represents the peak of industrial activity since a larger number of persons were engaged in industry in 1918 than in any other year.

The report also brings together tables from the reports of the Interstate Commerce Commission for railways, from those of the Bureau of Mines for mines and quarries and from those of the Bureau of Labor Statistics for the iron and steel industry. More elaborate treatment of these groups may be found in the publications of the bureaus mentioned.

A section is devoted to miscellaneous industries such as the manufacture of agricultural machinery, the automobile industry, building construction, paper mills, etc. These have largely been assembled by the National Safety Council and serve to supplement the showing of the industrial classifications in the several states. Indeed since these are presented by means of standard rates they give a much better idea of conditions with reference to accidents than is afforded by the number of accidents as shown in the state reports.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Tools for Beading Tapered Cups

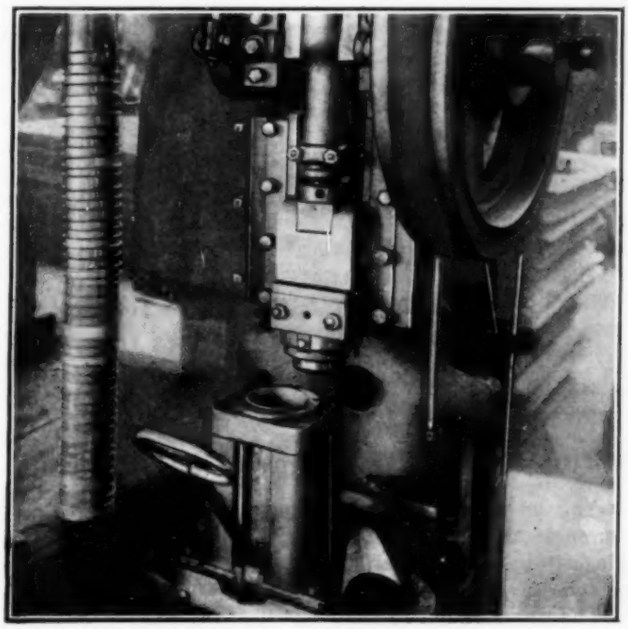
BY JOHN WILLIAMS

The sheet metal cups, vases, or whatever they may be called, a stack of which may be seen in the accompanying illustration, require a bead to be rolled upon the large end after the longitudinal lock-seam has been closed, and their tapered shape renders them a somewhat difficult proposition because of a tendency to buckle under the pressure of the beading tool.

The die, shown in its outward position in the press, is gibbed to the die-bed in such manner that it may slide to and from the column of the press a distance of several inches, far enough for the work to be loaded into and removed from the holder without interference with the upper tools. When in its rearward position, the slide contacts with a stop screw and the upper and lower tools are in alignment.

The lower tool is a conical holder of steel, hardened, and ground to fit the shape of the work. There are no bottoms in the cups at this stage, and when they are set into the holder they surround a four-part expansion arbor that projects upward from the bottom of the holder to about one-half the height of the cup.

The lever with the ring handle, to be seen in front of the lower tool, has a movement up and down through an arc of about 90 deg., and has pinion teeth cut in a part of the periphery of the small hub at its lower end. This pinion meshes with the rack that is a part of the expanding plug of the arbor. When a cup is set into the holder the lever is in its lower position and the expansion arbor will enter the open small end of the cup.



BEADING TAPERED CUPS OF SHEET METAL

When first set into the holder, the work projects above the top of the latter for about half an inch. The operator then lifts the handle of the lever to about the position in which it appears in the picture, this action expanding the arbor to conform to the shape of the cup and drawing it firmly down against its seat with just enough material projecting above the holder to form the bead. When this position is reached the lever will swing no farther, but continued pressure applied by the hand of the operator causes the entire tool to slide as a unit toward the press until it contacts with the stop screw before mentioned. The double purpose of expanding the arbor within the cup and of moving the die to operating position is thus effected with one movement.

When the bead has been rolled, a pull on the same lever brings the tool to its outward position for unloading and at the same time throws down the lever to a horizontal plane, from whence, upon being released by the operator, it will fall to its lowest position by gravity; completing the collapse of the expansion arbor within the cup and at the same time operating an ejector that shoots the beaded cup out of the holder.

CONSTRUCTION OF BEADING PUNCH

The beading punch does not differ in shape, so far as its rolling surface is concerned, from ordinary tools of this type, but the tapered nature of the work necessitates a departure from the usual construction.

A piece of round stock is first sawed apart lengthwise, two cuts at right angles, thus reducing it to quarter sections. The sawed surfaces are then smoothed up and the quarters sweated together with spacing strips between them so that the workman again has a round piece to work upon, but with the advantage that he can separate it into its original quarters by the mere application of sufficient heat to melt the solder.

The punch is made quite short in proportion to its length and is fitted in a holder to which it is held by four inwardly projecting fingers that enter a peripheral groove in the punch in such manner that the latter has practically no end movement with relation to the holder, but is not clamped against lateral movement.

On the end of the punch opposite the curling surface (the top as it is held in the press) an annular groove is cut, and to this groove an expanding snap ring is fitted. The depth of the groove in relation to the length of the punch is such that when the ring is in place it is nearly on a level with the exterior curling surface.

On being finished, the punch is hardened and tempered, and, as a matter of course, the first thing that happens in the fire is that the punch separates into four quarters. The spacing pieces are taken out and discarded. Assembled into the holder, the snap ring holds the parts of the punch outward against the confining walls of the holder, but when the pressure of the operation comes upon it the parts can move inward against the action of the snap ring as the punch settles into the tapered cup.

Automatic Tools for Making an Instrument Case

By E. D. Benson

The enormous demand of the automotive industries for instruments such as ammeters and speedometers has developed many interesting manufacturing methods and tools.

In Fig. 1 are shown the different operations on an instrument case, performed automatically from blanking

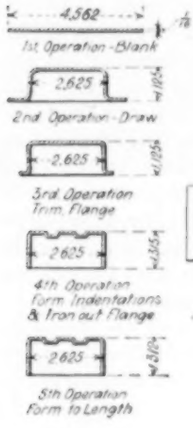


FIG. 1

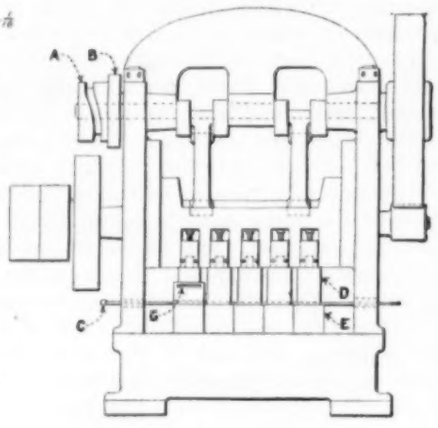


FIG. 2

FIG. 1—STAGES OF OPERATIONS. FIG. 2—THE PRESS USED

to finishing the case. The stock is $\frac{1}{16}$ dead soft cold-rolled steel, fed from rolls through the press from front to back. As the blank is punched out it drops down to carrier bars. In the carrier bars are five sets of jaws. The first set is made to hold the blank, the second set to hold the first draw and so on. As the slide of the press goes up all the jaws close at once, then move over one position to the right, open up and return. In this way each shell is carried to the successive die and one complete shell is made every stroke of the press.

The press used is shown in Fig. 2 and is of the double-crank type. *A* is the cam to actuate the slide bars. *B* is the cam to open and close the jaws in the slide bars. *C* shows location and side of slide bars, there being two which are parallel one on each side of the dies. The punches and dies in position in the press are shown by *D* and *E*. *G* is the slot in the stripper through which the stock is fed automatically by the roll feed mechanism, not shown.

The punches and dies are shown in detail in Fig. 3. *A* and *B* are the blanking punch and die. The plunger *C* holds the blank down on strips *D* in order that the jaws on the carrier bars *E* can get a better hold. The first drawing punch and die are shown by *F* and *G*. Shedder ring *H* has an annular locating ring, to locate the blank as it is left by the carrier over the drawing punch. It also has a slot *I* to allow the shell to pass to the right.

The shell is carried by the carrier bars over to the right and under the flange-trimming punch and die *K* and *L*. Its exact location is made by a sliding locating ring. The scrap stock from the trimmed flange is cut in two pieces by the scrap cutters *M* on either side of the trimming punch *K* and falls through the openings *N* in the die shoe. The shell is ejected from the die by the knockout *O* and held in location for the gripping jaws by plunger *P*.

The punch and die for ironing out the flange and thus increasing the draw and also indenting the shell end for the bearings are shown by *Q* and *R*.

The shedder ring *T* is depressed by the ring *S*, thus allowing the shell to locate on the punch *Q* before the die comes into action. The last operation, that of sizing the shell for length, is done in the punch and die *W* and *V*.

As the slide of the press goes up the ejector *X* lifts the shell from the sizing punch *V* and allows the three spring-actuated slide jaws *Y* on shedder ring *W* to complete the lifting of the shell from the punch and place it in position for the jaws in the carrier bars *E*, which carry the shell to the finished work-box chute.

The press runs continuously at from 50 to 55 strokes per min. and produces one complete case every stroke.

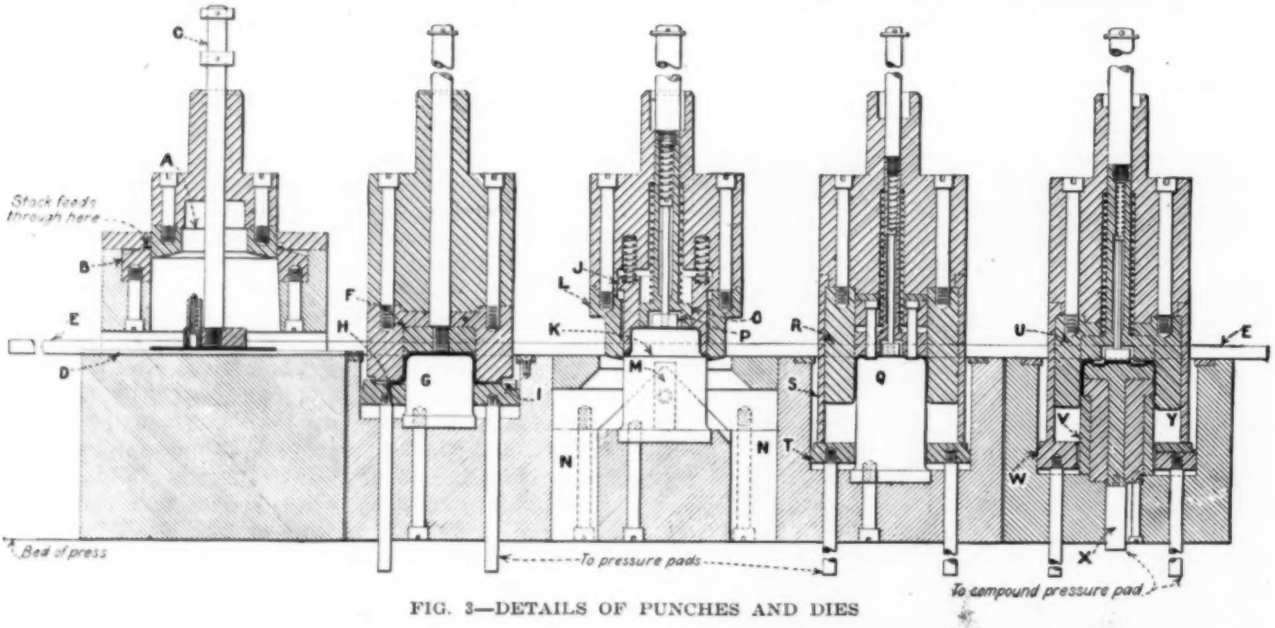


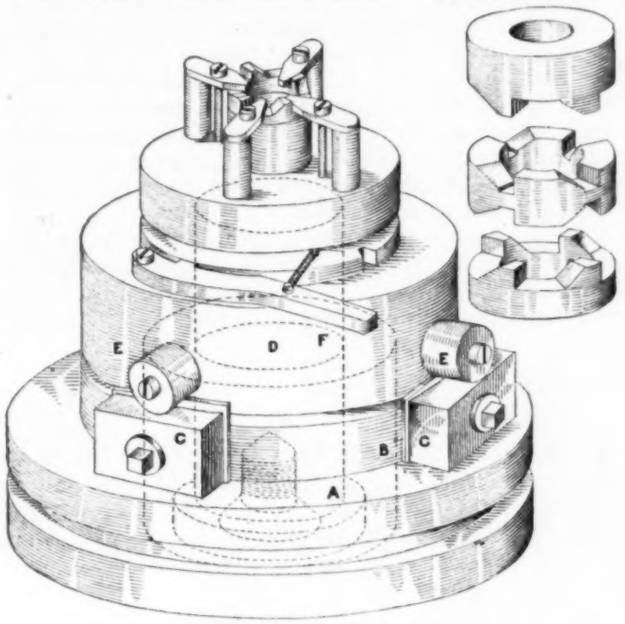
FIG. 3—DETAILS OF PUNCHES AND DIES

Shaper Fixture for Planing Clutch Teeth

By H. Rose
London, England

Some time ago our shop was called upon to furnish a large number of small clutches. The job presented no serious difficulties except in the machining of the angular relief on the backs of the clutch teeth, which must be quite exact in order to match nicely and must all be alike for interchangeability. To finish this part accurately and uniformly and to get out the work on a production basis in the matter of time, we made the holding fixture, shown in the accompanying sketch, to go on the shaper.

The device is small and is made entirely of steel, no



FIXTURE FOR PLANING ANGULAR RELIEF ON CLUTCH TEETH

castings being used. The base *A* is round and has a square-sectioned groove sunk into its periphery to accommodate the clamps which hold it to the shaper table. To an accurately finished hole in this base, the turned projection on part *B* is nicely fitted, so that the upper part of the device can be rotated or moved up and down with respect to the base without side shake or tilting.

Three formers *C*, are made of heavy sheet steel, the upper edges being ground to an angle that will impart the required rise and fall to the central, or work holding, part of the fixture to correspond with the shape of the clutch teeth. These formers are spring-tempered and ground together to insure uniformity. They are secured to the base by suitably shaped clamps that force them to conform to the circular shape of the shoulder against which they abut. Right or left hand helics are produced upon the work by merely reversing the position of the formers.

The holding part of the fixture *D* is made to turn in part *B*, but is so secured to the latter that it can move up and down only as part *B* is moved by the rollers *E* bearing upon the formers. Four notches in part *D* with which the projection on lever *F* engages, serve to locate it in each of the four required positions with respect to the formers. The lever also provides the means of feeding the work to the cut.

The original intention was to attach a worm driven feed-motion to part *D* so that power could be applied, but as it was found to be quite practical to feed by hand with this lever, the power feed was never made.

With this fixture the four angular relieved surfaces of each work piece are planed at one setting, with the assurance that all will be alike and that the several pieces of the lot will interchange.

Punching Insulating Material

By J. F. Cavanagh

Punching and stamping parts made from sheet insulation, such as Bakelite-Dilecto, is facilitated by heating the sheet and warming the tools slightly. It is rather difficult to heat a sheet uniformly on a hot plate and furthermore, but one sheet can be heated at a time in this manner.

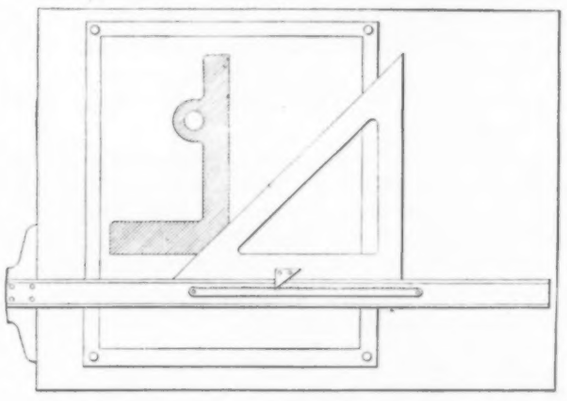
A very satisfactory way to heat a number of sheets at one time is to provide a shallow tin pan of sufficient size and support it over a gas plate as near the press as possible. A few pieces of iron rod should first be laid in the bottom, then several sheets of the insulation to be stamped, preferably with pieces of wire between them. Enough lubricating oil should be poured into the pan to cover the sheets and the gas lighted. Use a thermometer to regulate the temperature of the oil.

When the sheets or strips, as the case may be, are removed and placed in the die, the oil adheres tending to hold the heat and also to lubricate them. This method permits the rapid production of stampings from heat proof fiber that cannot be easily produced otherwise.

A Simple Device for Spacing Section Lines

By G. A. Luers

The sketch shows a simple and effective device to assist the draftsman to draw in section lines evenly. It consists of part of a worn hacksaw blade suitably



SECTION LINING DEVICE FOR DRAFTSMAN

attached to the blade of the T-square, and a piece of thin sheet steel, fastened to the triangle for a pawl.

In use, the triangle is moved back one, two, or three notches of the saw blade as required for each line drawn, the click of the pawl over the teeth of the blade indicating to the draftsman how far it has been moved.

Because of its simplicity the device can easily be manipulated with one hand.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN
Editors
August 30, 1923

The Cost of Changes in Design

IT'S A WISE inventor or engineer who knows when to stop improving and let well enough alone, for the time being, at least. No one wants to throttle or discourage improvements and real advance, but if the business is to succeed, the cost of manufacture must be considered. And constant changes cost real money and tend to prevent profits.

It frequently happens that the inventor or engineer has the improving bug so strongly that it takes a firm handed and hard hearted manager to keep him within bounds. We have talked so much about "constant progress" and "never be satisfied," that we have lost the balance between serviceable products and a wild desire to be always putting out something new.

One of the surest ways for the production manager to check constant changes and at the same time to build up an alibi for the increased cost, is to keep a detailed record of the total cost of these changes. It frequently seems foolish to the inventor to object to making what seems to him like a slight change after a job is under way. It only took him a few moments to erase one line and make another, on the drawing board. But it's a vastly different thing to make even a slight change in the pieces themselves, particularly after part of the lot has gone through.

If the production manager will follow the cost of such changes in detail, and present them to the general manager with his protest, it will take a smoother tongued inventor than usually happens, to get away with it. But if, as sometimes occurs, the general manager and the inventor are one and the same person, it's a good plan to hunt another job before the sheriff comes to tack up his sign.

Of course there are a few notable exceptions to this —and their scarcity is what makes them notable. Maintaining a correct balance between preventing too many changes, and still keeping the product a bit ahead of its competitors, is a real test of management.

The Increasing Interest In Higher Education

A REMARKABLY enlightening digest of a report on the public education problem has just come to our attention. It was prepared by N. B. Henry under the direction of the committee on education of the Chicago Association of Commerce and is well worth reading.

Perhaps the most striking statement is the one relating to high school enrollment. According to the report, one in ten of the population of the United States reaching high school age in 1890 entered high school. In 1922 the proportion was one in three. As high school education is more than twice as expensive per student as elementary school training it is not astonishing that the tax rate is on the increase.

The desire for higher education is undoubtedly an excellent thing for the country as it raises the standard of intelligence of the average citizen. Under existing conditions there is one drawback, however. It is the preference of the high school graduate for a white collar job. Financial returns being equal, the boy can hardly be blamed for selecting the occupation that seems pleasanter and cleaner. As a consequence there is a shortage of good, competent mechanics and an oversupply of clerks.

Here is something for employers and manufacturers to think about. What can be done to make the job in the shop attractive? A fair wage and a good future must be offered to draw the more desirable type of high school graduate. He is good raw material for future executives, he does not need so much shop schooling as the ordinary apprentice and his mind is better trained to absorb instruction more quickly.

Not only must the job be made worth while but some means must be discovered to reach the boys and tell them about it. Isn't it a good opportunity for the various manufacturers' organizations?

A Sign of the Times

EVERYONE is convinced of the fact that mechanical transportation is rapidly forcing the horse into the obscurity of obsolescence. The situation is accepted with the calm matter-of-fact assurance with which Americans receive any mechanical achievement. Wonders have burst upon us so frequently of late years that we have almost lost our capacity for surprise and it takes something very unusual or more than usually commonplace to jar us into realization.

The daring attempt of a Maughan to fly from New York to San Francisco between sunrise and sunset elicits more admiration than surprise. The very practical application of his venture, if it proves successful in the end, and the hard work and serious thought expended in supplying him with the vehicle for his flight, are lost to view in the sporting flavor of the attempt. Do you ever stop to think how such a suggestion would have sounded ten years ago? Probably not, for we are living too fast and too much in the present to spend much thought on the past.

On the other hand some very commonplace thing may pierce our armor of indifference and bring home to us the speed at which we are traveling into a completely mechanical age.

Not many days ago we (speaking editorially) had this very thing happen to us as we were jogging peacefully through an unfamiliar part of New England in our own tin plate chariot. Our four-year-old Bluebook advised us to take a right hand road at a fork marked by a large stone watering trough. The mileage was right and the road signs agreed with the Bluebook but there was no watering trough. Instead there was a flaring roadside gasoline pump. Could one ask for better evidence of the tendency of the times?

Shop Equipment News

Cincinnati Centerless Grinder

A centerless grinder with interesting features has recently been developed and is now being marketed by the Cincinnati Milling Machine Co., Cincinnati, Ohio. The machine will grind shoulder work as well as straight cylindrical parts and is therefore available for push rods, shackle bolts, valve tappets and similar pieces.

A grinding wheel 20 in. in diam. is mounted on the left end of the main frame casting as shown in Fig. 1. Opposite to it, a wheel 12 in. in diam., and known as the feed or control wheel, is arranged to control the rotative speed of the work in traverse between the wheels. In its movement the work is supported on a work support blade, mounted on a work rest placed between the wheels. The feed or control wheel is carried in a bracket which can be swung about a horizontal axis and clamped in an angular position relative to the grinding wheel. The speed of the control wheel determines the rotative speed of the work held between the wheels and its inclination determines the feed or lap per revolution of work. Proper grinding is done only when the speed and feed of the work are adjusted to the requirements of the job and for this purpose the control wheel speed change box provides 16 changes of speed from 11 to 442 r.p.m. The range of the machine is, therefore, wide and it has sufficient flexibility to be classed as a jobbing machine.

The tilting housing is gibbed to a sub-slide to which it can be securely locked, and upon which the work rest is also mounted. Both the control wheel housing and the sub-slide can be moved forward individually or as a unit by means of the large pilot wheel shown at the right in Fig. 1. This individual adjustment decreases the time required to set up the machine and is a real advantage when the machine is used for jobbing work. In setting up the machine for a new job it is only necessary to move the sub-slide carrying the work rest into proper relation with the grinding wheel, and then to move the control wheel housing on the sub-slide until the piece is ground to the proper size between the wheels. The unit adjustment is used to compensate for wheel wear and a fine adjustment of the slides is secured by means of a crank and dial reading in ten thousandths of an inch.

The machine is furnished either belt- or motor-driven but the motor drive is strongly recommended. A 10 to 15 hp. motor running from 1,200 to 1,800 r.p.m. is required and is mounted on the bed as shown in the illustrations. In the lower part of the frame under the grinding wheel spindle is a constant speed shaft driven through a chain from the motor or by a belt, in the case of a belt-driven machine. A 5-in. belt runs up to the main grinding wheel spindle from this shaft, and a swing idler, adjustable from outside the machine, keeps the belt at proper tension. The drive for the control wheel is taken from the same shaft and transmitted to a speed box bolted to the bed. From the last shaft in the speed box the control wheel is driven by means of a 3½-in. belt. Proper tension on the control wheel driving belt is secured by means of a double compensating idler adjusted by a small handwheel adjacent to the adjusting pilot wheel. This special adjustment is necessary to make the belt run properly on the control wheel spindle when the wheel is set in an angular position. The illustration, Fig. 2, shows the drive arrangement.

Since any tendency toward vibration would prevent accurate and satisfactory work, special attention has been paid to the solidity of the grinding wheel mounting and adjustments for wear in the bearings. The grinding wheel spindle is a heat-treated chrome nickel steel forging, and is mounted in the main frame of the machine which weighs 4,000 lb. The bearings are of the half-box type and are lined with a special white metal, dovetailed in. The spindle is held down in the bearings by the downward pull of the driving belt. The spindle oiling device consists of two disk type splashers which dip in oil reservoirs and carry the oil up to collectors in the bearing cap from where it is distributed over the bearing. Shoes in the cap may be

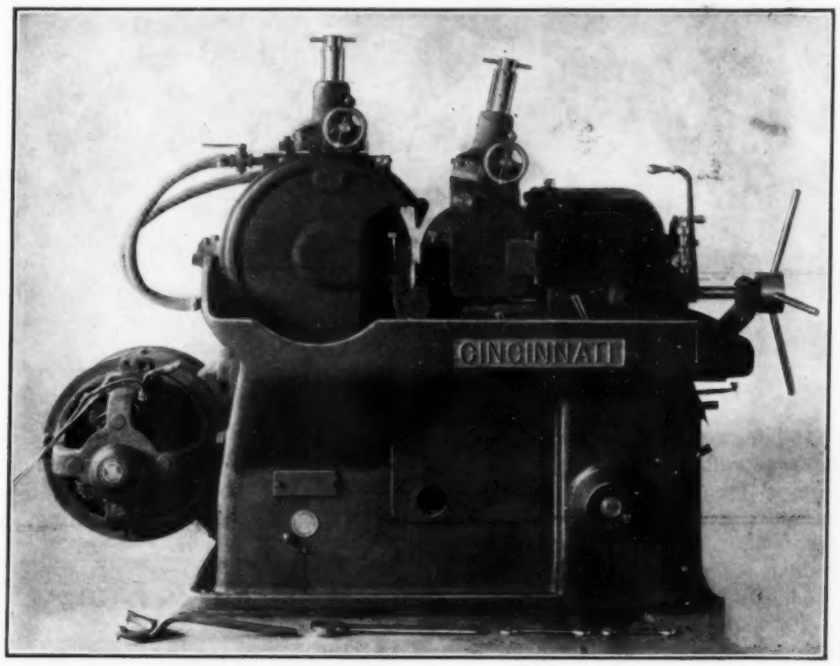


FIG. 1—CINCINNATI CENTERLESS GRINDER

brought down on the spindle by adjusting screws and are provided as a safeguard in case the belt should break. The end thrust is carried by means of a double-row self-aligning ball bearing, and it is possible to adjust the position of the spindle while running.

Both grinding wheels are mounted on collets, a method which is advantageous when wheels have to be changed frequently as it is not necessary to redress the wheels excessively when they are placed on the spindles. The wheels can be changed rapidly and easily as the guards are hinged and the entire front or operating side of the machine opens up.

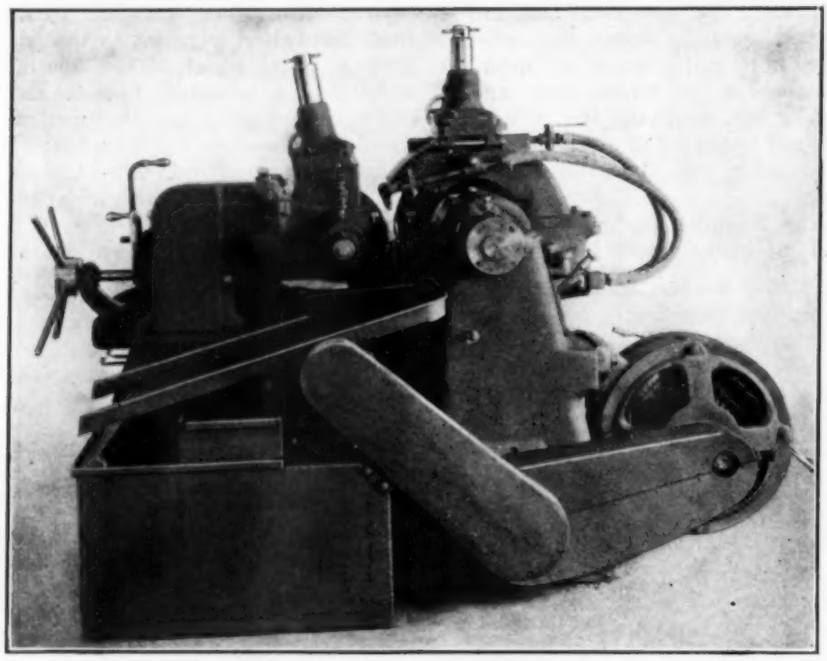
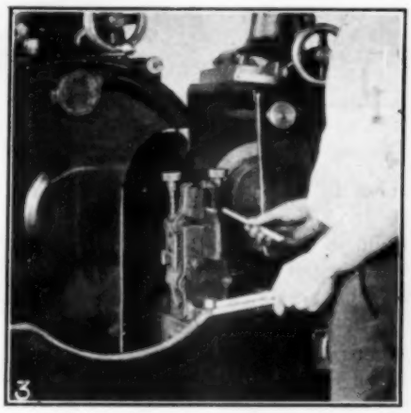


FIG. 2—REAR VIEW OF CINCINNATI CENTERLESS GRINDER

The wheel truing devices for the wheels are convenient, as they are mounted on the guards where they remain in position, ready for use at any time. The diamond is carried in a sleeve mounted in a sliding bracket which is moved across the wheel by means of the handwheel shown at the front in Fig. 1. The sleeve may be moved up and down in the bracket for different diameters of wheels, and a micrometer dial for fine adjustment is provided at the top. The control wheel truing device also has adjustments to take care of the angular setting of the wheel. The highest control wheel speed, 442 r.p.m., is to be used for truing and is instantly available by shifting a lever in the speed box.

The guides for the work rest are of high-speed steel and can be easily removed for resurfacing. Each guide section is adjusted and locked independently by means of a thumb nut so that changing from one size of work to another is easily done. The wearing surface of the work-holding blades is stellite, electrically welded to steel to give a hard and durable wearing surface. A flat top blade is used principally for roughing and a 45-deg. angular or knife edge blade for finishing, although the flat top rest can also be used for finishing.



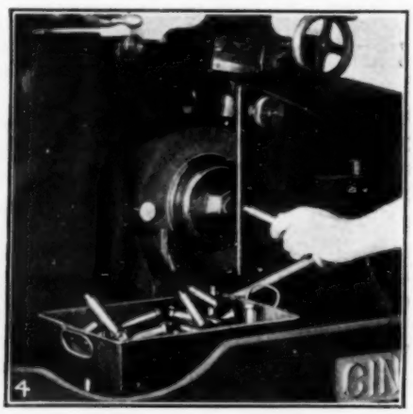


FIG. 3—GRINDING STRAIGHT CYLINDRICAL WORK ON CINCINNATI CENTERLESS GRINDER. FIG. 4—SHOULDER WORK GRINDING

The standard work rest is used for plain cylindrical grinding and Fig. 3 shows the machine being operated on this class of work. The piece to be ground is placed on the work rest in contact with the wheels and passes through between them, falling into a chute, shown in Fig. 2 at the rear of the grinding wheels.

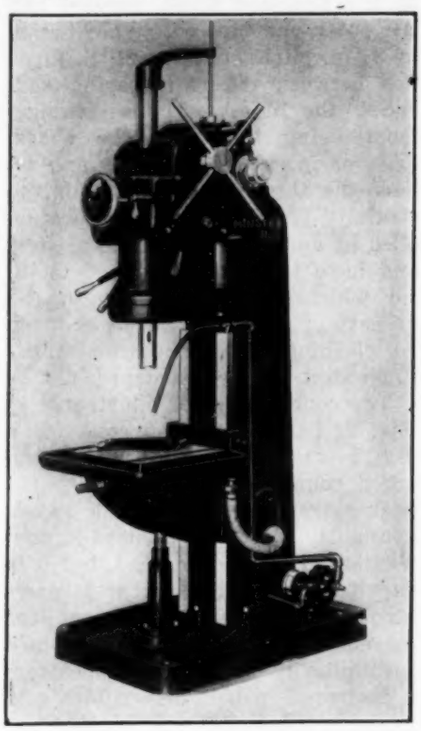
For shoulder grinding the standard work rest is replaced by the shoulder-grinding work rest as shown in Fig. 4. A 90-deg. movement of the lever on the control-wheel feed moves the control-wheel housing either forward or backward through a distance of 0.030 in. With the wheel withdrawn the work is laid upon the angular work rest and located endwise by an adjustable stop. As the lever is moved, the control wheel is brought forward and pushes the work against the grinding wheel, the desired size being secured when the lever has made its full movement. As the operator withdraws the control wheel, he presses the ejecting knob, on which his left hand rests, and the piece is pushed forward into a pan set to receive it.

A centrifugal pump is mounted on a removable lubricant storage tank set at the rear of the machine as shown in Fig. 2. The pump is driven by a belt. The bed of the machine at the grinding-wheel end forms a primary settling basin from which the lubricant overflows to a secondary settling basin on top of the storage tank. It is then delivered to the tank through a cloth bag and a clean supply of cutting lubricant is insured.

The capacity of the machine on the standard rest is from $\frac{3}{8}$ to $1\frac{1}{2}$ in. in diam. and a special rest can be provided to take work from $1\frac{1}{2}$ to 3 in. in diam. The standard blades take work up to 10 in. long and accessories can be furnished which will permit the grinding of work up to 8 ft. long. Both grinding wheels have a 3-in. face and a 5-in. hole. Wheels with 4-in. face can be supplied if desired. The net weight of the motor-driven machine is 5,000 pounds.

Minster No. 9 Drilling Machine

The Minster Machine Co., Minster, Ohio, is now marketing its No. 9 "Hi-Duty" drilling machine, which is designed to handle drills up to 1½ in. in diam. and has several interesting features, as shown in the accompanying illustration. The machine is of rugged construction and all the drive



MINSTER NO. 9 DRILLING MACHINE

and feed gears are enclosed in the head housing at the top of the column.

The drive shaft of the machine is driven by a belt from a motor or a countershaft, and may be fitted with tight and loose pulley, single pulley with single friction clutch, or single pulley with double-throw friction clutch for reversing the motion. The latter arrangement provides for a tapping attachment, the reverse speed being 1½ times the forward speed.

Two mechanical speed changes are provided which, with a series of change gears give a range of speed from 73 to 550 r.p.m. in four steps. The gears are conveniently located at the front of the head and close to the lower end of the spindle. The sliding gears giving the two speed changes are shifted by a lever conveniently located at the left side of the machine.

Sliding gears in the feed drive also provide two mechanical feed changes, and these, together with a set of change gears, give a series of four feeds from 0.006 to 0.159 in. per revolution of the spindle. Hand feed for the spindle is made possible by placing the sliding gear shift lever at the neutral position. The spindle construction provides for 15 in. length of feed. A guide rod, upon which is mounted an adjustable stop, can be set to trip the feed at any desired point, and an adjustment can be made so that the spindle will automatically return to its original position. The diameter of the spindle is 2⅜ in. and the diameter of the sleeve is 2⅛ in. The spindle has a No. 4 Morse taper and is located 10½ in. from the face of the column.

The machine is equipped with a heavily ribbed plain table which is mounted on a wide bearing on the column. The finished surface of the table is 16x16 in. and a vertical movement of 15½ in. is available. The maximum distance from the end of the spindle to the table is 30 in. A compound table with the usual adjustments can also be furnished.

An oil reservoir is located in the lower part of the main head casting and a geared pump in the head forces the oil up through the vertical clutch shaft, from where it runs back to the reservoir over the gears and bearings. The cooling compound reservoir is located in the base of the column from where the coolant is delivered to the tools by a rotary geared pump.

The net weight of the machine with plain table is 2,065 lb. and the driving pulley speed is 550 r.p.m. For motor drive a 5-hp. constant speed motor running at from 1,100 to 1,300 r.p.m. is recommended if the machine is to be operated at its full capacity.

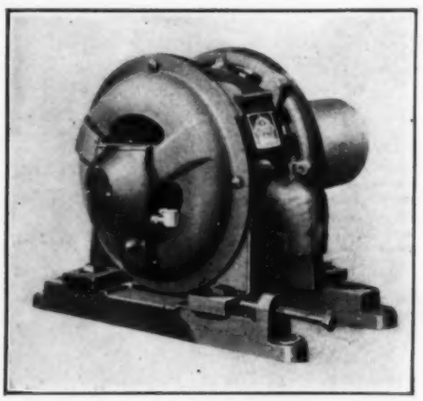
Reliance Type AA Induction Motors

A series of two- and three-phase induction motors has been added to the line of industrial motors manufactured by the Reliance Electric & Engineering Co., Cleveland, Ohio, and are now being marketed. These motors are designated Type AA, and are of the squirrel-cage type, built in capacities from ½ to 25 horsepower.

The frames are of the riveted type in which the stator laminations are assembled between the end flanges, the end flanges being held together by heavy rivets. The feet are cast integral with the flanges, and planed parallel to the shaft. This operation, and the machining of the end flanges for the bearing brackets, is done after the riveting has been completed to insure correct alignment.

The stator coils are wound of cotton-covered enameled wire and well insulated in the slot and between the phases. The complete stator is subjected to a varnishing and baking operation to make the coils resistant to the destructive effects of dirt, moisture, oil, acids and alkalies.

The bearing brackets completely protect the heads of the stator coils



RELIANCE TYPE AA INDUCTION MOTOR

and carry the bearings, which are of the ring-oiling type, with a large oil reservoir in the housing. The brackets are interchangeable for both ends and can be rotated to allow for floor, wall or ceiling mounting. The bearings are of phosphor bronze, shouldered in the brackets and securely locked against rotation.

The rotor core is made up of special electrical sheets punched to receive the rotor bars which are hard drawn copper and made to fit tightly in the slots. Copper end rings are cast on the ends of the bars after they are assembled in the core. It is claimed that this construction makes the rotor practically indestructible at a point usually weak. To insure a uniform air gap the surface of the rotor is ground to size. The shaft is made from high-carbon steel, and ventilation is assisted by fans attached to the rotor core.

These motors are regularly supplied with slide rails, a standard paper pulley and, in sizes above 5 hp, an oil-immersed starting compensator having both no-voltage release and overload protection.

Pratt & Whitney 16-Inch Lathe, Model B

The Pratt & Whitney Co., Hartford, Conn., has recently placed on the market an engine lathe designed for use in the tool room and in high production manufacturing operations. Designed for a self-contained motor drive, using a geared head, the lathe is also available with either geared-head single pulley drive, or a cone head and countershaft drive. Fig. 1 shows the lathe with geared head and motor drive.

The lathe swings 16½ in. over the shears and 9⅝ in. over the carriage.

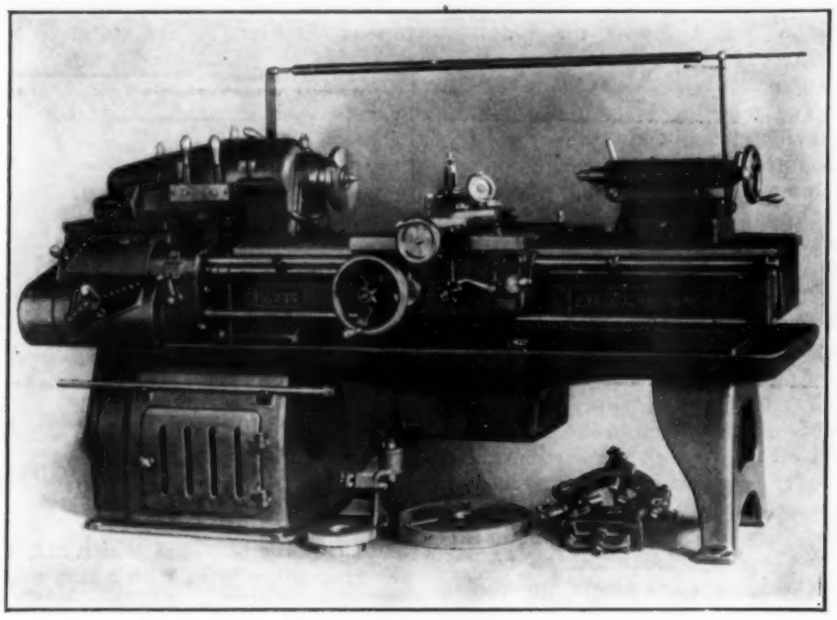


FIG. 1—PRATT & WHITNEY 16-INCH LATHE

It is made in 7-, 9- and 11-ft. bed lengths, the first being the standard size as usually furnished. The geared-head lengths between centers are 39, 63 and 87 in., while the corresponding cone-head dimensions are 36, 60 and 84 in. The floor space occupied by the standard 16x36 in. machine is 3 ft. 3 in. by 8 ft. 8 in., and the over-all height is 4 ft. 10 inches.

For the geared head a compact headstock has been worked out by placing the "back gears" beneath the spindle, together with the main drive gears. This results in greater compactness and the elimination of overhanging parts. When the back gears are "out," the main driving gear is locked to the spindle by a full gear clutch similar to that used in the transmission of automobiles. It is engaged or withdrawn by means of the small lever on top of the headstock, and may be engaged in as many positions as there are teeth in the gear. The back gear operating lever is at the inner end of the headstock, below the driving plate, and is provided with a positive lock for both the "in" and "out" positions.

The first drive shaft is located back of the bed and below the level of the shears. The lathe is started and stopped by means of a Carlyle Johnson friction clutch operated by a shoulder-high control rod running the entire length of the machine. This rod in the stop position applies a brake, and in the running position the speed gears cannot be shifted. The maximum ratio of drive shaft to spindle is 45 to 1 and the minimum nearly 1 to 1.

The spindle speeds in the geared head are controlled by two interlocking levers on the front of the headstock as shown in Fig. 1. Eight speeds from 13 to 525 r.p.m. in geo metrical progression are possible, and are easily determined by an index plate and pointers. The speed gears run partly in an oil reservoir which is located in the base of the headstock, and all enclosed gears are either in the oil or are splash oiled from the reservoir. The spindle gears are supported upon bearings independently of the spindle.

The live spindle is hardened, ground and lapped to its bearings. It runs in split-sleeve composition bearings, tapered on the outside and fitted with ring units to allow compensation for wear. The front bearing is 2⅞in.x4⅞in., and the rear bearing 2⅞in.x4in. in size. A thrust bearing composed of hardened and ground steel running against cast iron sustains the end pressure. There is a 1⅛-in. hole through the spindle, the front end being bored to a No. 16 Jarno taper and fitted with a bushing to take a No. 4 Morse taper center. The outside of the spindle nose is made with two separate bearing surfaces, the one next to the shoulder being parallel and the outer one tapered. The thread, of 3¼-in. pitch, standard U. S. form, lies between the two bearing surfaces, the object of this arrangement being to center the chuck, drive or faceplate accurately and relieve the thread of any part of the strain. The spindle is separately oiled by cups. All gears are of steel and have the Maag form of tooth. for which exceptional strength and operating efficiency are claimed. All clashing gears are chrome-vanadium steel and are hardened.

The cone headstock, illustrated in Fig. 2, has a four-step cone for a 4-in. belt and is provided with a two-speed countershaft which, with the back gears, renders 16 spindle speeds available. No clutch is used in connection with the cone head, but it is supplied with a brake that is operated by the hand or forearm, the movement being the same as would involuntarily be made by operators accustomed to belt driven lathes in braking the spindle by placing the hand on the large step of the cone.

The arrangement of the motor drive is shown in Fig. 3. A five horsepower motor is placed within a cabinet leg at the head end of the lathe, and is mounted on a hinged platform, the latter acting as a belt-tightening device. A belt from the motor drives the shaft at the rear of the bed, which connects with the spindle through the friction clutch and gears previously mentioned. Electrical equipment, such as low voltage protection, master switch, etc., is provided, and the motor is started or stopped by means of a push button switch convenient to the operator's hand.

The gear box provides 36 changes of thread and feed, ranging from 1½ to 80 pitch and from 0.0012 to 0.0665 in. per revolution of spindle, respectively. No gears need be changed in the train except to cut 11½ pitch or to translate from English to metric pitches.

Changes are effected by means of two levers shown upon the box in Fig. 2, which is provided with a "di-

rect reading" index plate to be used in the following manner: The ratio lever at the left end of the box has three positions, corresponding to the three horizontal spaces upon the plate. The various positions of the rocker lever correspond to the vertical columns. To set the box to any desired pitch of thread or rate of feed the operator has only to place the two levers so that the horizontal and vertical lines indicating their position intersect at the proper numeral. Rates of feed as well as the pitch of thread appear on the index.

The shifting pinion of the gear box runs in a heavy and rigidly supported tube, or trough, the upper portion of which is cut away over its full length just sufficiently to allow the pinion to mesh with the tumbler gear. The bore of this tube is ground to an accurate diameter and is the bearing which carries the pinion itself, the latter bearing only upon an extension of the tops of its teeth. By this construction the pinion is solidly suported by the tube in whatever position it may be, and the splined shaft that drives it is relieved of any side thrust due to the action of the gears.

The leadscrew is 1⅜ in. in diameter and has a single, right-hand, Acme thread of 4 pitch. It connects in direct line with the short shaft in the gear box upon which is the nest of gears. The connection is through a positive clutch that can be engaged at two points with reference to its rotation. The small crank handle to the right on the gear box operates this clutch and at the same time disengages the feed rod so that when the latter is running the leadscrew is idle, and vice-versa. End pressure of the screw is borne by accurately lapped thrust washers made of tool steel, and mounted in a rigid bearing on the right end of the gear box.

The apron of the carriage is of the double-plate type and all active studs are bronze bushed and supported at both ends. The rack pinion is carried by a substantial ball bearing. A clutch provides for disengaging the traverse handwheel so that it may be idle when the lathe is used for thread cutting. All gears and bearings in the apron are oiled from a reservoir in the wings of the carriage.

The traverse and cross-feeds are operated through separate trains and the worm of each train is supported in bearings independent of the feed rod so that the latter is relieved of side pressure and has only to drive the trains. The worms are of steel and the worm wheels are of bronze. The ratio of traverse to cross feed is 1 to 1, so that by locking in both feeds a tool point may be caused to travel at an angle of 45 deg. to the line of centers. This feature, in conjunction with the taper attachment, enables the cutting of tapers that would be beyond the range of the attachment alone.

Direction of rotation of feed rod or lead screw is reversed by means of a lever to the right of the apron. A knock-out rod with adjustable dogs provides for the automatic disengagement of either at predetermined points.

A feature of the cross slide is the mechanism for the quick withdrawal of the slide, for convenience in thread cutting. The regular cross-screw passes through and takes its thrust bearing in a large diameter bushing that has a quick pitch screw cut upon its exterior surface. By locking the screw and bushing together, a reverse movement of the handwheel of the cross-screw withdraws the slide at a rate many times in excess of the regular movement. A positive stop, entirely independent of the thread stop, insures the return of the tool point to exact position.

The compound rest may be swung to any angular position, the base being graduated in degrees for convenience in setting. The operating handwheel of the compound screw is inclined to a 20-deg. angle above the line of the screw, and transmits its movement to the latter through bevel gears. This construction provides ample clearance for the hand when cross and compound slides are set parallel, and allows easier reading of the graduated ring on the handwheel.

The carriage is provided with the usual clamping devices and with a chasing dial. Micrometer dials upon cross and compound screws are graduated to half-thousandths so that a movement of one line indicates a reduction of one full thousandth in the diameter of the work. Felt wipers at the ends of the carriage wings keeps the shears clear of dirt and chips.

The tailstock is provided with the usual set-over feature to be used when it is desired to turn tapers in this manner or to readjust the alignment of centers. It is clamped to the shears by an eccentric clamping device under and in line with the spindle, operated by means of a conveniently placed lever. Instead of the usual split barrel, the spindle is clamped by means of a long wedge keyed beneath it to prevent rotation. This wedge furnishes a positive grip, which is delivered over a considerable length of the spindle and does not tend to displace the center point from true alignment. The wedge is operated by the short vertical handle to be seen behind the tailstock at the forward end.

The tailstock spindle has a No. 4 Morse taper hole for the center and the inner end of the hole is routed to take the tang of a standard taper shank. A crosswise drift hole allows such shank to be drifted out, or they may be ejected by running them back against the screw. The tailspindle

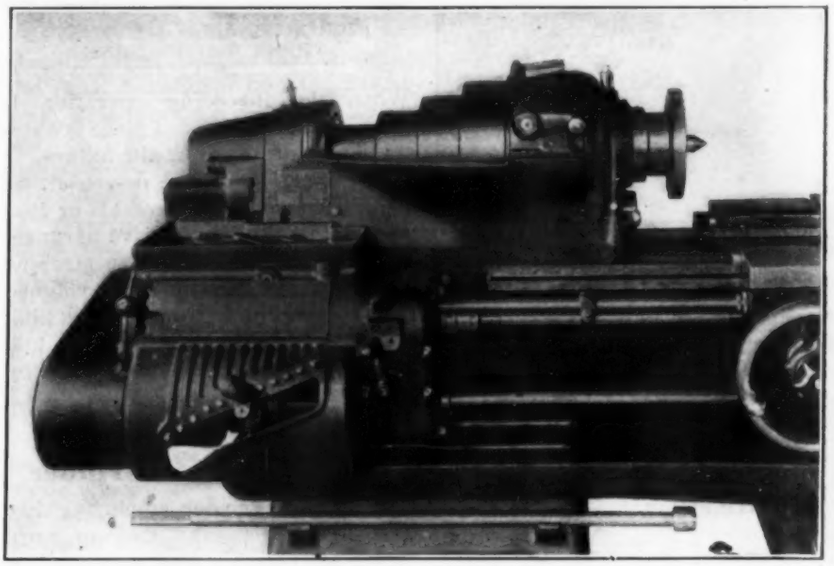


FIG. 2—CONE HEAD FOR PRATT & WHITNEY LATHE

is graduated in sixteenths of inches and has a horizontal line at the height of the centers to facilitate the setting of thread and form tools.

Collet and step chucks, ball turning rest, elevating rest, relieving

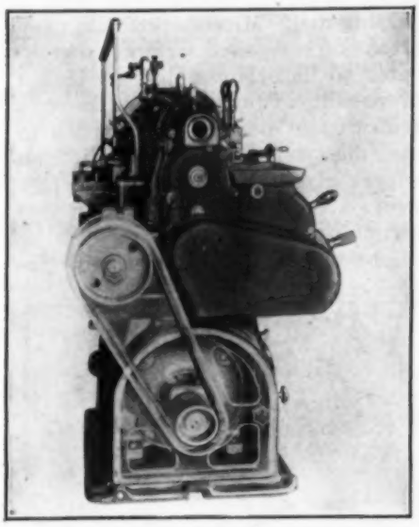


FIG. 3—MOTOR DRIVE FOR PRATT & WHITNEY LATHE

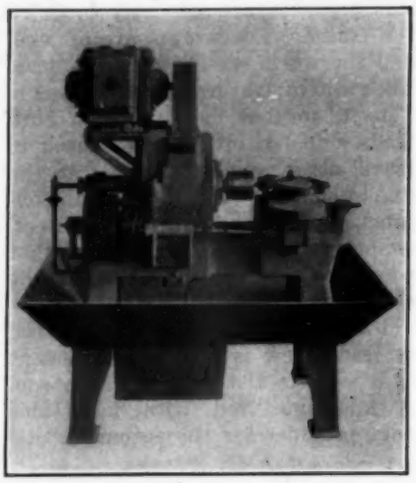
attachments, taper attachments, etc., are furnished as accessories. The regular equipment includes compound rest; drive, chuck, and faceplates; knock-out rod and necessary wrenches. Either lathe with 7-ft. bed weighs approximately 4,000 lb. without the motor.

Rickert-Shafer Automatic Threading Machine

An automatic single-purpose threading machine has recently been added to its line of threading equipment by the Rickert-Shafer Co., Erie, Pa., and the accompanying illustration shows a machine as built for threading spark plug shells.

The self-opening diehead, manufactured by this company, is carried on a spindle which is mounted in Gurney ball bearings and travels to and from the work under the action of the cam at the left end of the machine.

In the machine illustrated, the work is carried in an eight-position turret fixture which is automatically indexed, bringing a new blank into position each time the die-head advances. Fixtures and cams can be supplied for threading operations, within the range of the machine, on such work as connecting rod bolts, steering arms, spark plugs and a variety of work of a similar nature.



RICKERT-SHAFER AUTOMATIC THREADING MACHINE

When the threading operation is completed, the threaded piece is automatically ejected from the fixture.

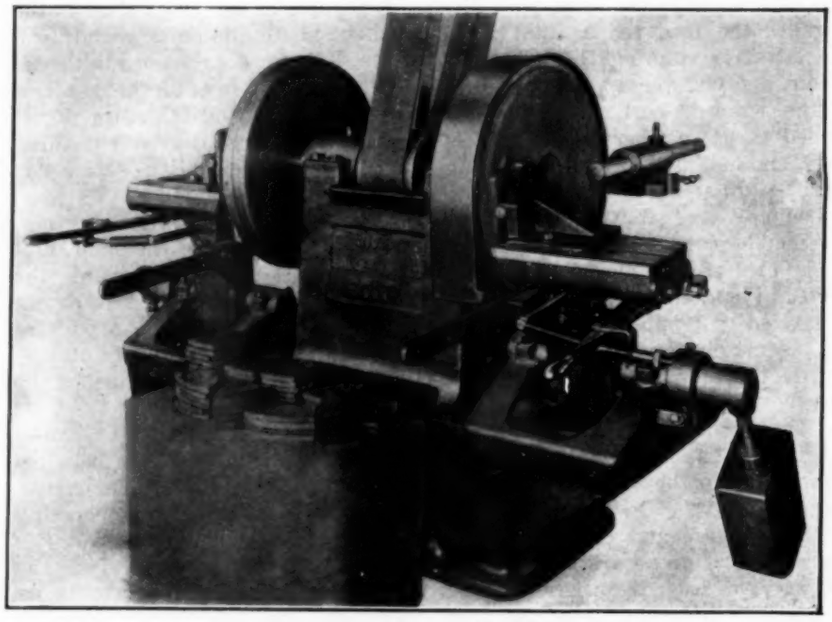
The machine can be driven either by a belt from a countershaft or by a motor. In the motor-drive arrangement, the motor drives the machine through a silent chain. It is claimed that this machine threads spark plug shells at the rate of 28 per min. and that two machines can be handled by one operator.

Badger Surface Grinder

A surface grinder employing two grinding wheels and rocking work tables has recently been developed by the Badger Tool Co., Beloit, Wis., and is now being marketed. The accompanying illustration shows the machine in process of grinding tops and bottoms of sole plates for electric irons.

The spindle carries two 24-in. abrasive wheels of the ring type and is mounted in bearings on the frame. The rocking tables are mounted at either end of the machine below the grinding wheels and their motion is imparted by the two straight levers shown in the illustration. The rocking mechanism is driven from the machine countershaft through a reduction gear at the rear of the machine. The work is held against the grinding wheel by an adjustable spring tension which acts through the hand lever on the table. It is claimed that this arrangement of work tables makes it possible for one man to operate both ends of the machine besides eliminating the heavy physical labor of feeding the work in and moving it back and forth across the face of the wheel.

When the piece in process is finished, the operator disconnects the table rocking lever, grasps the hand lever and draws the work away from the wheel, at the same time rocking the table forward until the work is clear of the wheel. The next piece is then placed in the fixture and the table is swung to the grinding position where the rocking lever again engages and causes the work to move slowly back and forth across the face of the grinding wheel. While this operation continues, the operator may reload the fixture at the other end of the machine.



BADGER SURFACE GRINDER

Stamp Type H Electric Hoist

An electric hoist, designated type H, has recently been placed on the market by the Stamp Electric Hoist Co., 968 East 69th Place, Cleveland, Ohio. The hoist has been designed to meet requirements of fast lifting speed and high lift and a feature of the device is the small number of parts.

The frame or housing contains a drum of large diameter which is driven by two reductions of gearing.

STAMP TYPE H ELECTRIC HOIST

A standard Weston load brake is provided and both the gearing and brake run in an oil bath. Hyatt roller bearings are used and the gears are of heat-treated alloy steel. The drum flanges fit the housing in such a way that the cable will not run off the drum.

The motor is carried on a bracket outside the housing and is connected to the hoisting mechanism through a flexible disk coupling. The coupling also acts as a pulley for the motor brake which is automatically operated by a cam on the controller shaft. A trip lever, connected by a chain to the controller wheel, returns the controller to neutral at the upper limit of the hook block.

The motor extension shaft is splined into the coupling and can be withdrawn by hand, together with the load brake, after the front cover has been taken off. The drum can also be removed through the front.

The trolley sides are of steel and the wheels are of chilled iron fitted with flexible roller bearings. The width of trolley can be adjusted for various sizes of beams and the current collectors can also be adjusted. The hook block has a ball thrust bearing, a steel yoke and covered sheave.

The hoist can be supplied for either direct or alternating current with single or variable speed control. Standard units have full-load hoisting speeds from 15 to 50 ft. per min., and lifting heights from 11 to 45 feet.

Ness Electric Spot Welder

An electric spot welding machine designed primarily for operation on alternating current, but which is also adaptable by means of a special device to the use of direct current, has recently been placed on the market by the H. J. Ness Mfg. Co., 305 Broadway, New York City. From No. 30 wire to ¼-in. rod may be welded on the standard machine with a 10 amp. fuse in the circuit, indicating that the current consumption at no time is more than 10 amperes.

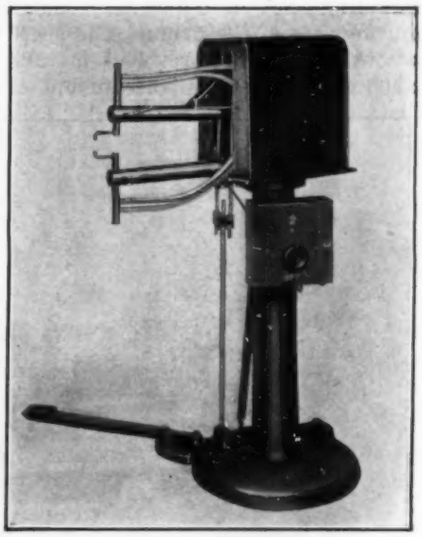
One of the features of this machine is that the transformer is located within 2 in. of the rear ends of both horns and midway between them. It is claimed that the closer the transformer is to the electrodes, the higher the efficiency of the machine, because the losses of current which occur when low-voltage, high amperage current is conducted any considerable distance are lessened. The electrodes are also heated more uniformly because the lead to each is about the same length.

Another feature of the equipment is an oil dash-spot switch which is said to practically eliminate sparking at the switch points, thus lessening the deterioration of these points, and to make the equipment sensitive by reducing the lag between the switch and the electrodes.

The upper horn is carried by a rocking arm lowered on the work by depressing the treadle. The upper electrode comes in contact with the work under spring pressure, the spring being further depressed until the current is turned on. Then the work is heated immediately to the welding temperature after which the current is automatically turned off. The weld is completed under a spring pressure that is adjustable to suit conditions. Finally, the electrodes are opened and the finished work is released.

Three welding steps for each voltage, to suit the different thicknesses of material handled are obtainable by means of a selector switch. Both 110 volt and 220 volt current may be supplied to the machine, in which case the lower voltage is used for work up to No. 10 wire and the higher voltage for No. 9 to ¼ in. More steps are optional. The 110 volt current is shut off and the 220 volt current turned on by means of a three step switch in which the only moving part is the knife.

In tests made when using the first step in welding No. 15 English gage iron wire, 3.75 amp. were consumed; using the second step in welding No. 14 English gage iron wire 4.4 amp.; using the third step in welding No. 10 English gage iron wire, 5.5 amperes.



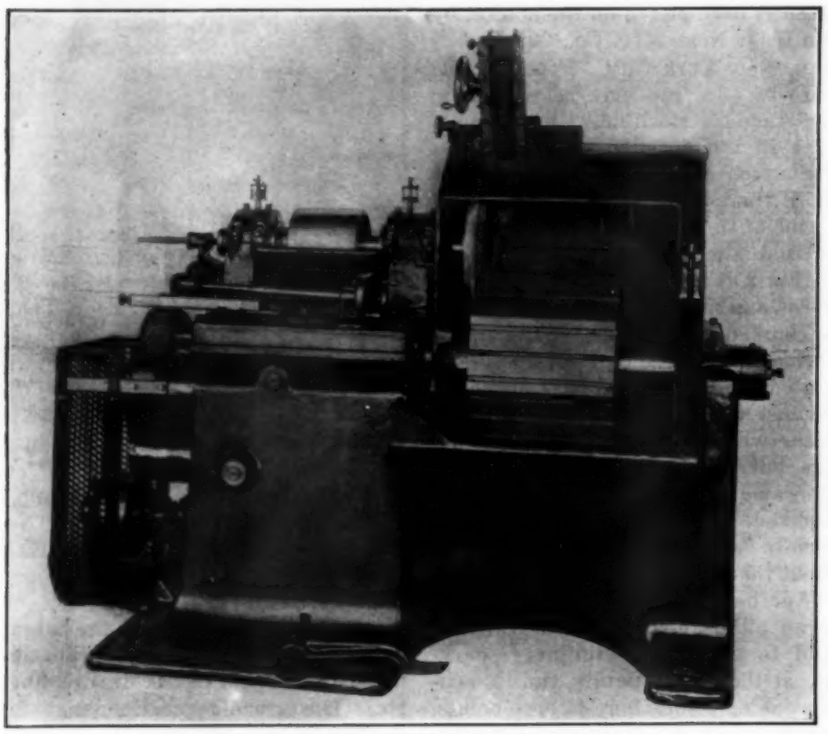
NESS ELECTRIC SPOT WELDER

There are seven adjustments on the machine for regulating the height between the horns, the pressure applied to the electrodes in welding, etc. The treadle position may be shifted 35 deg. to suit the convenience of the operator. The horns are cold-drawn copper bars, 2 in. in diameter, and are water cooled. The electrodes are secured in them by means of a hand-operated lever and cam lock on each horn. The distance between the horns when closed on the regular machine is 5 in., and on sliding-horn machines 5 in., minimum, and 16 in. maximum. The greatest movement of the upper electrode is 2½ in. and the distance from the floor to the welding points is 42 inches. The machine may also be motor driven for automatic operation, in which case ½-hp. motor is supplied. The weight of the alternating-current welder is approximately 450 lb., and of the direct-current equipment, about 550 pounds.

Gardner Semi-Automatic Disk Grinder

A recent addition to the line of grinding and polishing machinery manufactured by the Gardner Machine Co., Beloit, Wis., consists of an 18-in. semi-automatic disk grinder. The machine is designed for the grinding of parts which require the finishing of but one flat surface at a time.

The main feature of the machine is an octagonal drum upon which the parts to be ground are carried to the grinding position in fixtures mounted in the slots of the drum. The speed at which the drum revolves is variable, depending upon the amount of stock to be removed, the size of the area to be finished, and the speed with which the operator can unload and reload the fixture.



GARDNER SEMI-AUTOMATIC DISK GRINDER

The drum, as will be seen in the illustration, has two T-slots and one straight groove machine on each face, the latter to receive a tongue on the fixture and align the work with the grinding wheel. The drum shaft is 3 in. in diameter, has a bearing each side of the drum, and the end-thrust of the grinding operation is taken by a special thrust bearing at the end of the shaft. The motion of the drum is controlled by a pedal which operates a disk clutch at the left end of the machine. To start the drum the pedal is depressed and its release brings the drum to a stop.

The grinding spindle is mounted in a grinding head which is arranged to slide longitudinally in guides. As the work approaches the grinding position, the grinding head automatically advances until it reaches a positive stop. The head is pressed forward against the work by a spring whose action is controlled by a cam, and a constant pressure is exerted upon the work until the grinding is finished. The head is then returned by the cam.

The spindle is made from heat-treated alloy steel and is mounted in bronze bearings which are adjustable for wear. The thrust is carried by a hardened and ground steel collar which bears directly upon the spindle bearing, adjustment being provided by a nut and locknut on the opposite side of the bearing. The bearings are lubricated by sight-feed oil cups.

The grinding head proper is mounted upon a sub-base and is adjustable upon this base by means of a screw and handwheel. The handwheel shaft is geared to the screw so that adjustment is convenient for the operator, and the micrometer head provides close adjustment to compensate for wear of grinding disk or thrust collar. The ways upon which the grinding head slides are provided with shields for the exclusion of dirt and foreign matter and with gibs for taking up the wear.

The grinding member consists of an 18-in. steel disk wheel faced with the Gardner improved abrasive disk, or an 18-in. abrasive ring carried in a special chuck. The former is for dry and the latter for wet grinding. A cast-iron hood guards the grinding member and may be attached to an exhaust system. The wheel dresser is mounted upon a slide carried by the hood and is provided with a lateral screw adjustment for wheel wear. The vertical movement of the dresser across the face of the wheel is produced by means of a hand-operated pinion and rack.

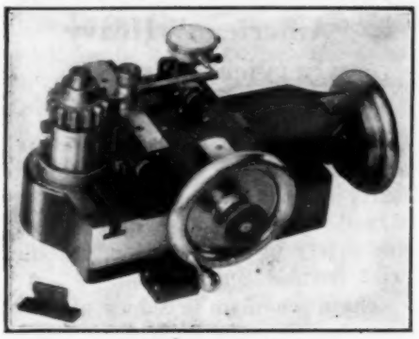
The spindle speed is 1,400 r.p.m. and the driving pulley speed is 560 r.p.m. The faces of the drum are 7x14 in. The machine requires 10 hp. for maximum duty.

American Grinder Co. Gear Tester

A gear tester, developed and manufactured by the American Grinder Co., 6534 Benson St., Detroit, Mich., has recently been placed on the market. The instrument is primarily intended for ground gears but can be used equally well on cut gears for developing, checking and charting involute curves and testing tooth spacing.

The machine consists of a base with a longitudinal slide upon which a transverse slide is mounted as shown in the accompanying illustration. Both slides are moved by screws with hand-wheels and micrometer heads. A slot is machined at one end of the base in which a stud for mounting the gear to be tested is clamped. On the transverse slide are mounted the contact finger or needle and an indicator by which the readings are taken.

For testing the involute curve of a tooth on a spur gear, an adapter with a base circle disk and steel tapes 0.005 in. thick are used. The indicator may be set to read direct or to multiply the readings by four. It is evident that as the transverse slide is moved, the contact finger will trace a true involute relative to the gear, since the tapes cause the slide to move a distance equal to the peripheral motion of the base circle disk. To take readings the transverse slide is set at zero and the contact finger is set at right angles to the slide by means of a gage. The gear is then set on the stud with



AMERICAN GRINDER CO.
GEAR TESTER

the indicator reading zero, and if the indicator remains at zero as the transverse slide is moved, the tooth curve is shown to be a true involute. Any deviation from the true involute is shown on the indicator and may be charted. To assist in gathering data for charting the curve, a plunger automatically retards the handwheel every 0.010 in. The charted curve for a true involute will be a straight line.

Tooth spacing is checked by using a fixed contact finger clamped to the slide, in connection with the indicating device. Tooth to tooth spacing or 90-deg. spacing may be checked. When it is desired to maintain a master curve or duplicate an established form, the longitudinal slide is used, first plotting the master and then checking the other curves with the chart. By making special adapters, spiral, bevel and other gears may be tested for spacing and contour. The normal capacity of the instrument is from ½- to 8-in. spur, helical and bevel gears, and the maximum is up to 12-in. spur gears.

Greenfield Improved Snap Gage

The Greenfield Tap & Die Corp., Greenfield, Mass., is now marketing a line of improved snap gages which

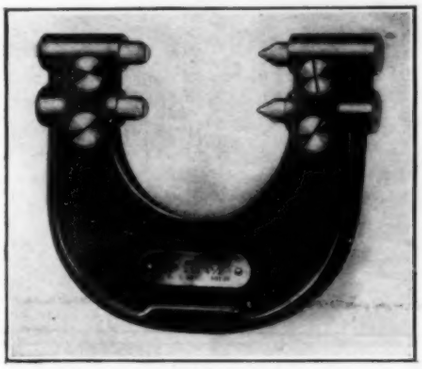


FIG. 1—GREENFIELD IMPROVED SNAP GAGE

is the result of a careful study of the usual defects found in such equipment and a design which is an endeavor to eliminate them. The general construction of the gage is shown in Fig. 1, and Fig. 2 shows the locking device for the anvils.

The locking device is the main feature of the gage and it will be noticed that the bearing of the individual locking bushings is on a flat on the anvils, so that they are held securely and prevented from turning. The gaging faces are maintained in alignment.

A stiffening web has been added

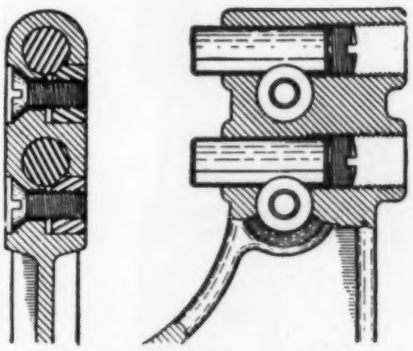


FIG. 2—GREENFIELD ANVIL LOCKING DEVICE

to the outer edge of the frame and makes holding the gage in the fingers easier when oily. Provision is also made for holding the gage in a stand. The frame number is cast in each frame, and a name plate is provided for special marking. Each size of gage has a wide range of adjustment.

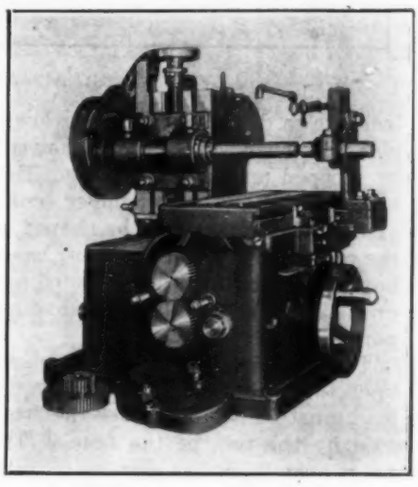
Weed Semi-Automatic Bench Milling Machine

A semi-automatic bench milling machine for the rapid and accurate production of small interchangeable parts has recently been placed on the market by the Weed Engineering Works, 738 Union Ave., Bridgeport, Conn. It is especially useful in the manufacture of small parts for firearms, sewing machines, typewriters and similar work.

In the design of the machine an effort has been made to secure greater rigidity and freedom from chatter than is found in the usual small bench milling machine. The machine is equipped with tight and loose pulleys with a convenient shifter for a belt 1½ in. wide. The driving pulley is 6 in. in diameter and runs at 300 r.p.m. The spindle is a steel forging, hardened and ground and running in bronze bearings. The arbor is hardened and ground and dogged to the spindle. The arbor diameter is ⅝ to ¾ in., and the spindle has a No. 7 B. & S. taper.

The working surface of the table is 3⅝x12 in. The table has a large oil recess on all sides, and is fitted with an adjustable taper gib. The feed motion of the table is 10 in. and the feed is engaged by a feed trip lever which operates forward and reverse clutches. The trip lever is operated either by hand or by feed dogs on the table. The working feed is driven by a worm and gear, and the reverse through bevel gears from a shaft at the back of the machine. Feed changes are made by changing gears at the front of the machine and four changes are available from 1.145 to 5.26 in. per min. Spindle speeds are changed by changing gears in the driving head, and six speeds from 80 to 268 r.p.m. may be used. The automatic quick return of the table takes place at the rate of 92 in. per minute.

The tank for cutting lubricant is located in the base and a pump of ample capacity is provided. The maximum distance from top of table to spindle center is 5½ in. and the minimum, 1¾ in. The net weight of the machine is approximately 450 pounds.



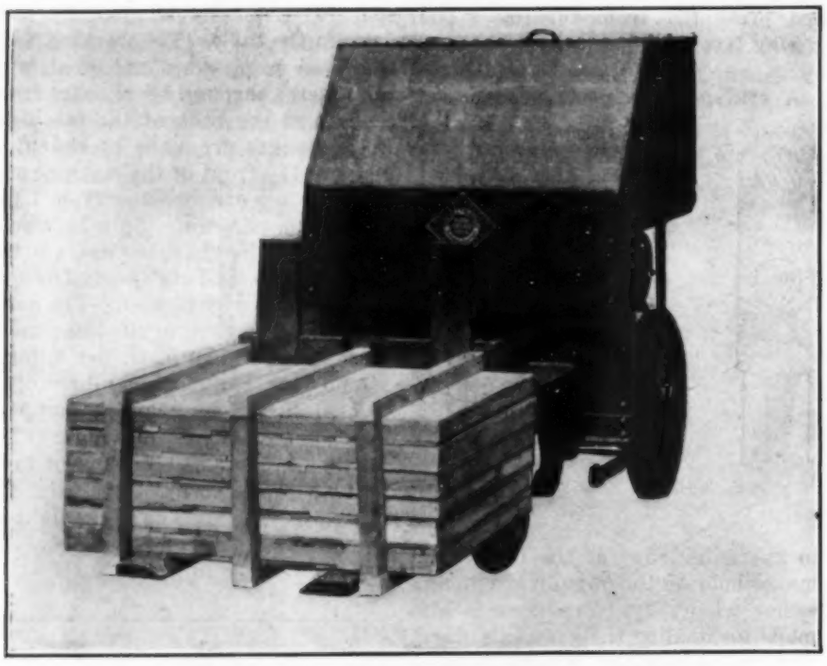
WEED SEMI-AUTOMATIC BENCH MILLING MACHINE

For semi-automatic operation the work is secured to a proper vise or fixture by the operator and the feed lever is tripped by hand. The table then feeds to the completion of the cut when the adjustable stop reverses the feed mechanism and the table is returned at the higher speed to the starting position. It is stated that one operator can handle several machines, the number, of course, depending on the length of the cut.

Elwell-Parker Electric Fork Lift Truck

An electric fork lift truck is a recent addition to the line of industrial tractors and trucks manufactured by the Elwell-Parker Electric Co., Cleveland, Ohio.

The machine is essentially an electric truck with provisions for carrying a 2,500-lb. load beyond the front axle. The forks which support the load are so designed that their lower side will touch the floor, and they can be stopped and held at any position between the lower and upper limits of lift. The forks may be shaped at the outer ends so that bundles, bales, boxes, castings or other commodities or packages may be lifted and transported.



ELWELL-PARKER ELECTRIC FORK LIFT TRUCK

The length of the forks depend upon the weight to be carried, as the load must be balanced over the front axle by the rest of the truck. The front axle, therefore, carries a heavy load and is strongly made and fitted with roller bearings.

The lifting mechanism consists of a separate motor, with a worm gear reduction, which is attached to a movable platen supported on the truck frame by three rocking links. The electric mechanism is assembled as a unit.

The power or propelling unit consists of a heavy duty Elwell-Parker motor direct connected to a worm and wheel drive through a flexible coupling. A bevel pinion differential running in oil together with drive shafts and clutch plates bolted to the outside of the wheels comprise a full-floating driving axle. The drive shaft universal joints are of chrome-vanadium steel. The drive wheels turn on 7-in. ball bearings.

All four wheels are steerable. The knuckles on both front and drive wheels are located close to the center of the tires. It is claimed that this construction insures easy steering and avoids any "kick-back" at the steering handle when the wheels strike irregularities or obstructions.

Automatic Cross Feed for "American" Heavy Service Shapers

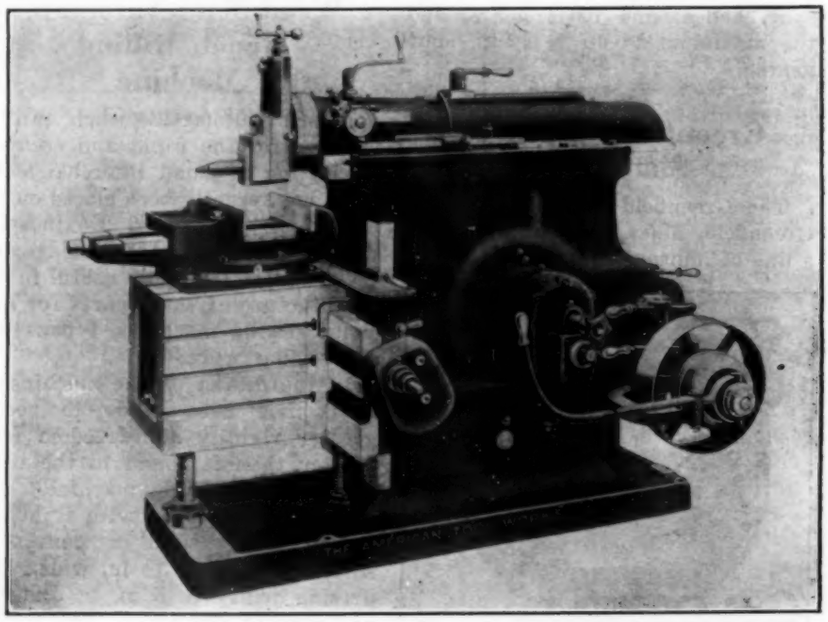
The American Tool Works Co., Cincinnati, Ohio, has developed an automatic feed mechanism for its heavy service shapers, which is designed to secure ease of operation and safety in manipulation, together with durable construction.

The mechanism is shown attached to a shaper in the illustration. With this device the feed occurs only during the return stroke of the ram and throughout the entire stroke. The mechanism is therefore protected against shocks, the feed rate is positive, and smooth, quiet action is insured.

The feed may be engaged, disengaged or reversed by the manipulation of one conveniently located handle. Throwing the handle to one side or the other engages the feed; movement of the handle from one extreme to the other reverses it; and leaving the handle at the center position causes disengagement.

Fifteen feeds are provided, ranging from 0.010 in. to 0.150 in. per ram stroke. Each feed is clearly indicated on a graduated dial and can be secured while the machine is in operation by turning the feed star knob until the desired feed indicated on the dial comes opposite a fixed pointer.

An automatic safety device is one of the features of this mechanism. It is claimed that this device will



AUTOMATIC CROSS FEED FOR "AMERICAN" HEAVY SERVICE SHAPERS

protect the feed mechanism against damage if the tool should gouge the work or the saddle be fed into either end of the rail. It is also stated that this safety means requires no adjustment, will pull heavy loads without slipping, and is not affected by atmospheric conditions, heat or oil.

Yale Low-Platform and Tractor Trucks

The Yale & Towne Manufacturing Co., Stamford, Conn., has recently added a low-plaform truck and a three-wheel tractor truck to its line of industrial transportation equipment.

The Yale Model K-23 low-platform truck is illustrated in Fig. 1, and is a general utility truck with a load capacity of 4,000 lb. The low-platform design reduces the amount of lifting of material necessary in loading the truck. As in other trucks of this series, recently described in the *American Machinist*, the complete assembly of the mechanism is made up of a number of standard subassemblies or units. This feature simplifies the mechanism and is of advantage in maintenance when several trucks of the series are in use. The wheel base is 54¼ in., the over-all width is 38 in., and the over-all length is 110¾ in. The total height is 53¾ in. and the platform space is 38x60 in. The height of the platform above the ground is 11 in. All four wheels steer and are of the disk type, made of pressed steel and provided with rubber tires. It is stated that the truck will travel at 6¼ mi. per hr. on a level concrete roadway with a 4,000-lb. load. The series motor runs at 1,800 r.p.m., continuous rating, on 36 volt current furnished by an Exide or Edison battery. The frame is of pressed steel with the main longitudinal members in one piece.

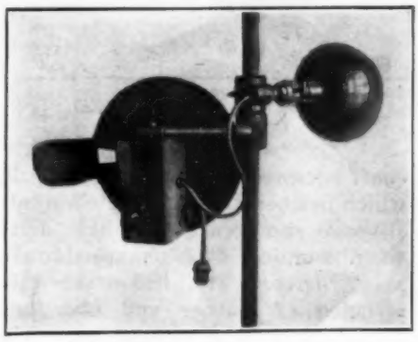
As shown in Fig. 2, the Yale Model K-24 three-wheel tractor truck is designed for hauling and small load carrying service in particularly congested spaces. The center of gravity has been kept low to reduce the tendency to "buck" or overturn against stalling loads, or to tip over sidewise while rounding corners. The frame is of pressed steel, arc-welded into a one-piece structure which combines battery compartment, bumpers and deck, and is suspended on helical springs over each wheel. The driving unit is the same used in other trucks of the series, as is the other electrical and controlling equipment. The wheels are rubber-tired, the drive wheels being of pressed steel and the front wheel a semi-steel casting.

The weight of the tractor with an Edison battery is 2,250 lb., and the wheel base is 42½ in. The width is 35 in. and the length is 82 in.

It is claimed that the tractor will haul four loaded trailers, a 16,000-lb. load, at a maximum of 4½ mi. per hr. on a level roadway. The seat is mounted on a swivel to make mounting and dismounting from the truck more convenient.

Rotostat Instrument Co. "Rotostat"

An instrument for the visual inspection of rapidly moving machine parts, known as the "Rotostat," has recently been placed on the market

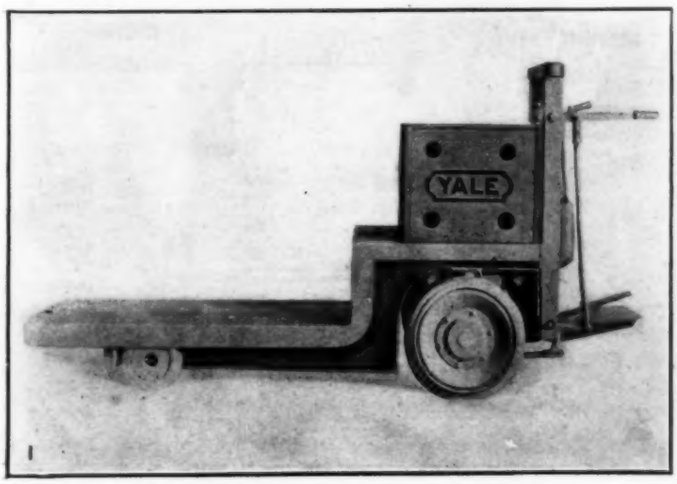


THE ROTOSTAT

by the Rotostat Instrument Co., 600 West Lehigh Ave., Philadelphia, Pa. This device is useful in detecting errors in timing of interlocking parts, unexpected interference, deformation of parts under centrifugal stresses, instantaneous and periodic speed variations and other facts about rapidly moving parts.

The instrument is connected to a convenient lighting socket and the moving object is viewed through the hood at the left in the illustration. The control knobs, which are located on the box at the center, are then manipulated until the object under observation appears to be standing still or moving at the required speed. An adjustable lamp and reflector is mounted with the instrument on a standard, the position of the instrument also being adjustable. No special illumination, battery, or special electrical equipment is necessary and a dim light is not required for good observations.

For machine shops the instrument is useful in visualizing the action of cutting tools and testing complicated automatic machinery. It is stated that erratic motion due to backlash of gears, slipping of belts and errors of balance are easily detected.



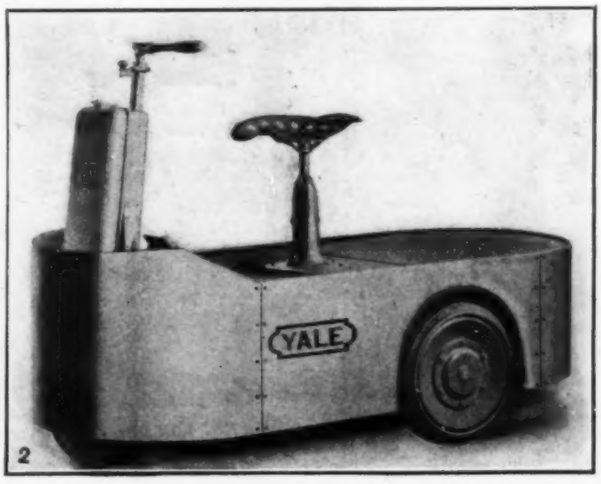


FIG. 1—YALE MODEL K-23 LOW-PLATFORM TRUCK. FIG. 2—YALE MODEL K-24 THREE-WHEEL TRACTOR TRUCK

Fox Duplex Horizontal Multiple Drilling Machine

The Fox Machine Co., Jackson, Mich., has recently built a duplex horizontal multiple drilling machine for machining nickel-steel automobile steering knuckles, and the machine is now being placed on the market for work of a similar nature.

As shown in the accompanying illustration, there are two spindle heads which are arranged to slide upon the long horizontal rails. The rails are bolted to columns at either end of the machine bed and to a pedestal at the center. A revolving work fixture is mounted above the pedestal, and has four stations, the loading station being at the front of the machine.

Each head carries six spindles and has an independent feed and knock-out. The two bottom spindles are 2¾ in. in diam. for drilling and carry 1⅛ in. drills. Two special boring spindles are located at the back of each head and are mounted in taper bearings which are adjustable for wear. The two top spindles are also 2¾ in. in diam. and carry ⅞ in. reamers.

The motor is mounted at the rear of the machine and drives the machine through a silent chain. The machine drive shaft also drives the spindle driving shaft through a silent chain.

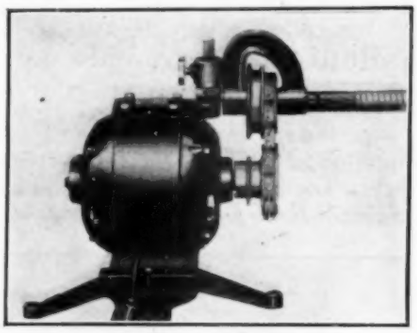
On the work mentioned above, the drills rotate at 250 r.p.m. and the drill feed is 0.839 in. per min., which is equivalent to 0.0034 in. per revolution of spindle. The feed controls are shown in the illustration at the front of the machine.

The cutting lubricant tank and pump are mounted at one end of the machine and the pump is driven by a belt from the motor.

Haskins Multiple-Speed Countershaft

A heavy type multiple-speed countershaft, for use with Haskins flexible shaft portable grinders, has been placed on the market by the R. G. Haskins Co., 516 West Monroe St., Chicago, Ill.

The main feature of the countershaft equipment is the link type belt, which has been designed to eliminate slippage and secure a positive drive when running at high speed on a short drive. The links are constructed of leather and fiber and joined by a steel connection. The pulleys have been widened and shaped to fit the links, so that as the belt engages the pulley, the link is wedged in just enough to secure a firm grip but not enough to cause any appreciable loss of power.



HASKINS MULTI-SPEED COUNTERSHAFT

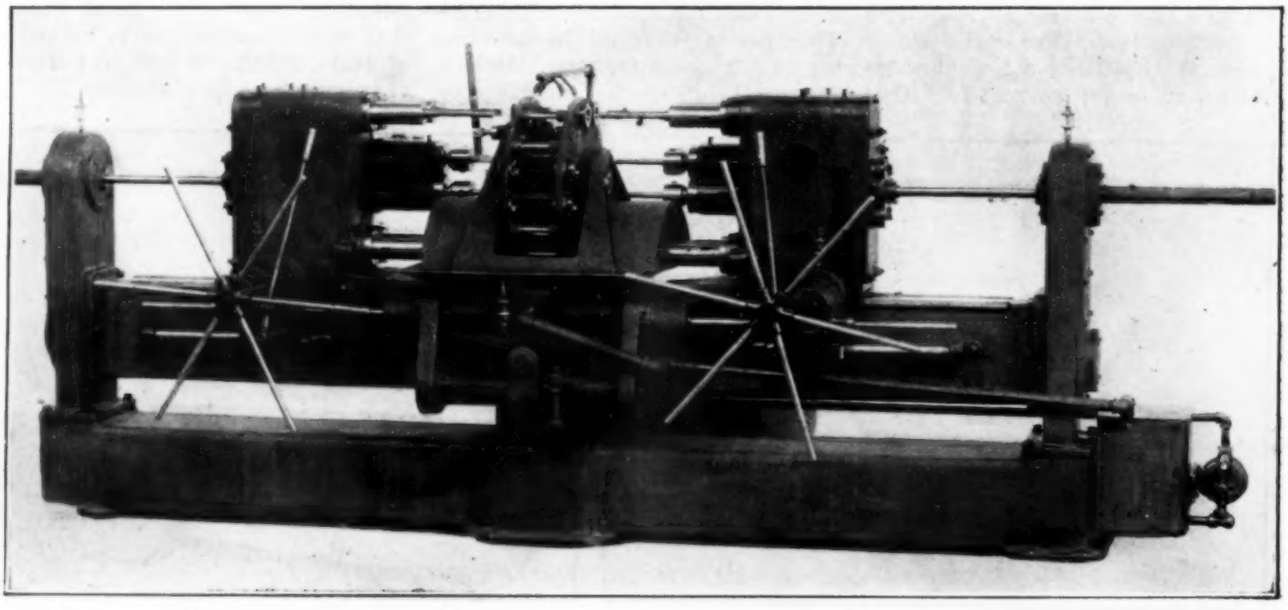
The countershaft provides a convenient method of attaching the shaft to the motor and gives the operator an opportunity to select a speed to fit the work. The link type belt is now furnished with all Haskins equipments.

Japanese Imports of Machine Tools

American machinery manufacturers interested in obtaining a broad view of happenings in their respective lines in Japan will find useful figures in the current issue of *Commerce Reports*, taken from the Japanese customs statistics.

A graphic analysis of these figures by the Industrial Machinery Division of the Department of Commerce shows clearly the comparatively insignificant part played in this business by the United States in the earlier years; the phenomenal growth of American participation in certain lines with corresponding waning of the British volume; and the subsequent regaining of lost ground by the British in some cases. However, it is worth noting that in many lines the American manufacturers are holding their own and even increasing their hold though the British have regained their former prestige, possible to a large extent in those lines of endeavor where the original machinery installed was British and the repairs and replacements were of necessity British.

In the earlier years the British controlled the market, but in the first part of 1915, owing probably to the war demands on British manufacturers, their participation in this business fell to a negligible quantity, while the American participation took a sharp upward trend in nearly all important lines.



FOX DUPLEX HORIZONTAL MULTIPLE DRILLING MACHINE

News Section

Planning World Power Conference for Next Summer

Next Summer the British Empire Exhibition is to be held at Wembley, London. In July, by permission of the Executive Council of the Exhibition there is to be held in connection therewith a World Power Conference, initiated by the British Electrical and Allied Manufacturers' Association, Inc., but participated in by many technical and scientific institutions and industrial organizations in Great Britain and other countries.

The announced purpose of the World Power Conference will be to consider how the industrial and scientific sources of power may be adjusted nationally and internationally in the following ways: By considering the potential resources of each country in hydro-electric power, oil and minerals; by comparing experiences in the development of scientific agriculture, irrigation and transportation by land, water and air; by conferences of civil, electrical, mechanical, marine and mining engineers, technical experts and authorities on scientific and industrial research; by consultations of the consumers of power and the manufacturers of the instruments of production; by conferences on technical education to review the educational methods in different countries, and to consider means by which existing facilities may be improved; by discussions on the financial and economic aspects of industry, nationally and internationally; and by conferences on the possibility of establishing a permanent World Bureau for the collection of data, the preparation of inventories of the world's resources and the exchange of industrial and scientific information through appointed representatives in the various countries.

The importance with which the conference is regarded in Great Britain is evidenced by the eminent engineers, scientists and industrialists and financiers connected with its organization and management of which the Right Honorable, the Earl of Derby, K. G. is president.

In response to invitations for American participation more than twenty American engineering technical and industrial organizations have appointed representatives to a Committee of Arrangements.

Working committees have been appointed and General Chairman Merrill is now in London gathering information as to the scope and details of our expected participation.

Invitations will be extended to other organizations that may be interested and it is the purpose and hope to make a contribution to this first effort toward a systematic study of the world's power resources and their utilization.

Three Roads Show July Gains

Three of the four railroads making reports of their earnings for July showed increases compared with the same month of last year. The Norfolk Southern, the smallest of the four, was the only one to show a decrease, and in that case the decrease was but $11,000.

The Philadelphia & Reading R.R. continued to show the recovery that it has reported in the last few months, with a net income of $1,954,742, as compared with a deficit of $192,512 in the same month last year. Although this was less than for June, when the railroad reported a net of $2,943,125, it was almost as great an increase as the June figures were in comparison with the June of last year, when the net income was $599,099.

In its July report the Wabash R.R. continues to show an increase in net income over the same month of last year with $633,295, against $532,868. This is in striking contrast to the same month in 1920, when the Wabash reported a deficit of $1,028,288. Gross income for the seven months' period of this year was $37,210,386, an increase of approximately $4,000,000 in comparison with the same period of last year. Net operating income for the same period was $4,778,053, against $2,963,305 in 1922.

The Western Maryland R.R. reported a net income of $386,391, against $249,369 in the same period of last year. This is accounted for in a large measure by the large increase in the gross revenues which were $2,005,106 for July of this year, in contrast with $1,215,616 in the same month of last year.

Spends 17 per Cent for Equipment

More than one-half of the funds expended by the Pennsylvania Railroad System during 1922 were immediately paid out in salaries and wages to the 220,000 employees according to a report compiled recently. This report was designed to show just how the "Pennsylvania dollar" was expended in 1922.

Out of every dollar received by the railroad during the year 51.4 per cent was paid to labor. The second largest slice out of the dollar went for the purchase of materials and supplies used in the every-day railroad operations. This expenditure required 17.07 per cent.

Coal for the company's system took 7.29 per cent. For taxes paid to cities, states, and the United States in 1922 a total of 4.54 per cent was taken from every dollar received by the railroad. At this rate, the railroad points out, the taxes, which have been increasing steadily of late, have now approximately reached a point where they are equal to the amount of dividends paid to the stockholders who own the railroad.

Record Car Loading in Seven Months

A new high record for car loadings in the first seven months of a year was revealed by the announcement that 27,957,211 cars were loaded in this period of 1923, just made by the Car Service Division of the American Railway Association. These figures were compiled from reports from railroads in all parts of the country.

Not only was this a greater loading than for a similar period in any previous year, but it was 4,683,387 cars more than were loaded in the same period of 1922. This is an increase of 20 per cent over last year, when car loadings suffered by the decrease in coal loadings due to the miners' strike.

One of the outstanding reasons for the increase in car loadings was the increase in general business. The loadings of merchandise and miscellaneous freight, generally accepted as a criterion of the manufacturing conditions throughout the country, were 1,638,140 more than last year, with a total of 16,466,907 cars.

Norton Company Holds Harvest Day

On Saturday, Aug. 25, the employees and executives of the Norton Co. assembled at the New England fair grounds on the outskirts of Worcester, Mass., for the "Harvest Day" which has been an annual event since 1914. Established originally as an exhibit of the farm products grown in the company gardens, the affair now includes a flower show, a pet show for the children, exhibits of fancy work, home cooking and arts and crafts, and an automobile parade with prizes for the best decorations. There was also an exhibit of the complete line of Norton products. This feature was introduced last year and was found to be popular because many of the employees have little chance to see what is going on in other departments of the plant during the year.

July Steel Ingot Output

Steel ingot production in the United States approximated 3,515,966 tons for the twenty-five working days in July, according to an estimate made by the American Iron and Steel Institute. This compares with an estimate of 3,748,890 tons produced in the twenty-six working days in June and 4,195,800 tons, the high monthly record in the history of the country in the twenty-seven working days in May. Output in July last year approximated 2,952,806 tons.

Waldo H. Marshall Dies Suddenly

The death of Waldo H. Marshall, president of the Consolidated Machine Tool Corp. of America, occurred Aug. 23 at his Summer home, Barnstable, Mass., following an illness of a week. Mr. Marshall's death came as a shock to his associates and many friends in the industry as he had been actively engaged in business up until the time he was stricken with appendicitis and he had been in the best of health for some time past.

Mr. Marshall had been identified with

WALDO H. MARSHALL

the locomotive building and operation and kindred industries since his graduation from college until he became associated with the Consolidated Machine Tool Corp. His first practical experience was in the drafting room of the old Rhode Island Locomotive Works. After considerable editorial experience both in Chicago on the *Railway Review* and in New York on the *American Engineer*, he became assistant superintendent of motive power of the Chicago & Northwestern Railway in 1897, going to the Lake Shore Railway in 1899 and advancing successively from superintendent of motive power to general superintendent and to general manager in 1903. Leaving this in 1906, he became president of the American Locomotive Co. and retained this position until 1917. From here he became identified with J. P. Morgan & Co. and in January, 1918, he was appointed chief of the production division of the Ordnance Department, U. S. A. He was also a member of the Naval Consulting Board and of the Committee on Industrial Preparedness of New York.

Following the war he was associated with the T. A. Gillespie Co. and the Gillespie Manufacturing Co., being chairman of the board of the latter company.

Upon the formation of the Consolidated Machine Tool Corp. of America Mr. Marshall was made vcie-president and held this office until he succeeded to the presidency made vacant by the sudden death of Columbus K. Lassiter on March 3. Mr. Marshall was largely instrumental in the formation of the corporation together with the late Mr. Lassiter.

Mr. Marshall was also a director of the American Brake Shoe & Foundry Co., the Bucyrus Co., and of the Chatham and Phenix Bank of New York City.

The body was brought to his New York home, 375 Park Ave., and the funeral was held from the Central Presbyterian Church. Only a few weeks ago Mr. Marshall's wife died. He is survived by his son and his daughter. He was fifty-nine years of age.

Eaton Axle Co. Buys Bumper Concern

An announcement has been made by J. O. Eaton, president of the Eaton Axle & Spring Co., of the acquisition of the inventory, machinery, patents and good will of the Cox Bros. Manufacturing Co., Inc., reputed the oldest manufacturer of automobile bumpers now in business.

The Cox company has plants in Cleveland and Albany and service stations in New York and Chicago. It is intended to open additional service stations in Cleveland, Boston, Albany and Philadelphia.

According to officials, the company is operating at the rate of $2,000,000 a year and profits are said to be satisfactory. It is figured as an important addition to the Eaton Axle & Spring Co., which is manufacturing Eaton and Torbenson axles and Perfection springs in plants at Cleveland and Pontiac, Mich.

Manufacturers Approve Safety Schools

A large number of Baltimore industrial plants have approved a plan which has been launched by the Baltimore Safety Council and which provides for safety schools for foremen and others engaged in the plants. Officials of the Safety Council expect about 1,000 men to take the course.

The course will include the organization of shop safety committees, addresses at plant safety meetings of superintendents, foreman and workmen, motion pictures dealing with accident prevention, standardization of accident statistics, fire prevention surveys and the study of labor turn-over and employment problems.

Electrifying Railroads in Brazil

Orders for new equipment totaling about $1,000,000 for electrifying 35 additional miles of the Paulista Railway, Brazil, have just been placed with the International General Electric Co. This extension constitutes part of the extra portion contemplated when the first contract with the International General Electric Co. was closed in 1920, providing for 28 miles of double track electrification, and brings the total electrified mileage up to 63 miles starting at Jundiahy and extending north to Tatu.

Production Steady in Buffalo

A survey of employment conditions in the automotive industry in the Buffalo district shows that there has been a decline in production during July and the first half of August and, to some extent, this condition is passed on to the smaller machine shops that depend on the automotive industries to any degree. While the reductions in force of the principle automobile factories have been in progress for some weeks, the machine shops making parts for these factories have not been effected radically as yet and are making their reductions far more gradually.

The Pierce-Arrow Motor Car Co. reports that its present employment figure is about 75 per cent of normal. However the company's production for the first six months of this year has been greater than in any six months in its history. About 3,900 men are employed at present and it is expected that the employment figures will gradually work up to normal, beginning with September.

Atterbury Motor Car Co. is running about 60 per cent of normal and about 10 per cent ahead of last July and August. The new Chevrolet assembling plant is putting on men already and expects to have approximately 600 employed by September. The normal employment eventually will be 1,500.

The Ford Motor Co.'s Buffalo plant is employing 750 men, which is 150 more than were employed in the Spring and nearly full capacity. The Dunlop Tire & Rubber Co., which was shut down last year, is reaching sizeable production figures and has not experienced any reduction this Summer.

Averages of employment in all Buffalo factories showed a reduction of about 3 per cent during July. However, most of the shops making heavy machinery are runninng to capacity and there is healthy activity in the forging plants, shops making railroad equipment and railroad repair shops.

South Has Many New Machine Tool Shops

Some idea of the remarkable development the foundry and machine shop industries of the South have experienced this year is shown in a recent report received in Atlanta from a reliable source by the Southern Metal Trades Association.

From January to July inclusive it is shown that more than 300 projects were carried out by metal trades industries of the southern states, either in new construction by existing companies or in new construction by new companies formed during that period.

In foundries and machine shops, the total reached about 175, while in other metal working plants the total exceeded 150.

In addition to this it is interesting to note that in the lumber industry the total of such projects amounted to more than 400, and in the woodworking industry, outside of lumber plants, more than 300. In the textile industries of the South the total was nearly 400.

It now seems practically certain that 1923 will prove the greatest year the South has ever experienced in the development of its industries.

Many Inquiries in Pittsburgh Market

In common with conditions in the iron and steel market, the machine tool industry is reflected in the quietness that prevails throughout the trade. Several sellers of new equipment say there is a moderately fair inquiry from surrounding districts, with occasional business resulting. However, it is said that many of these inquiries look so good that transactions are confidently looked for in the near future. Then there are other sellers of machine tools who appear to be in the inactive zone, and report the market as duller than it has been in the past four or five weeks.

The National Tube Co., which is the "leading interest" in tubular goods production, took definite action last week on its list of machine requirements for the new tube works at Gary, Ind. When the list was closed it consisted of a miscellaneous character for tool room installation, and included two small lathes, a slotter, a drilling machine, a boring mill, hack saws and other small equipment. The successful bidder was Manning, Maxwell & Moore, Inc.

Needed Equipment

Sales that have been consummated lately were of a compulsory nature, such as had to be secured in order to insure operation of plants, and in the main were replacements rather than new installations. It is difficult to close a sale of used machinery also, even when it consists of odds and ends and such small items as bench lathes and drills. From the middle West inquiries come almost every day in better volume than from any other section, and in a number of cases deals are being held up for the return of sales managers who have taken advantage of the dull period to slip off for a vacation. A seller last week was successful in closing a deal for a large boring mill that went to a shipbuilding company on the Eastern seaboard.

There has been a slight decrease in inquiries for cranes, but the builders say this is only temporary, and while there were no awards last week, several deals are hanging fire and may be consummated at any time. Quotations have been submitted, and it will not take long to do business when the right man gets on the job. A new 15-ton crane is to be placed at the new addition to the Railway Steel Co.'s plant at Latrobe, Pa. Several railroad orders in cranes are looked for very soon, according to dealers here.

Railroads Will Buy in St. Louis

The machine tool market in St. Louis has been rather spotty for the past two weeks. Some companies report a good business and are going along on full schedule, while others have found it necessary to cut down their forces somewhat and still others have reduced the number of working hours per week.

Railroads are not much more active in the market now than they have been for the past two months, but with most of them reporting a capacity business, manufacturers anticipate that this field will be more productive for the machine tool industry shortly.

Automotive plants that manufacture passenger cars are employed to capacity, but the truck makers have slowed up.

The Baltimore & Ohio R.R. recently purchased a large tract of land on the East side of the Mississippi River which it intends to use for new yards and for the erection of a large terminal.

Collections are reported better than for the past few weeks and the labor situation is satisfactory. Conditions generally are better than at this time last year and manufacturers are content with the year's total.

Milwaukee Reports Improved Trade

A distinct recovery from the dullness of machinery business during the greater part of June and July has been experienced in the Milwaukee trade in August, and as the month comes to a close the effect has been heightened by a steady growth of inquiries as well as sales. Manufacturers as well as dealers shared in the improvement. Individual sales in no case reached the proportions of round lots, the bulk of business being in single machines or a few items. The railroads and the automobile industry figured most prominently in sales.

The outlook, as viewed by leading men in the selling end of the machine tool trade, is encouraging for continued active business between now and Dec. 1. No one expects anything sensational to develop in the way of bulk sales, but steady, consistent buying which will form a fair volume in the aggregate, is expected. New orders coming to foundries and machine shops are increasing after being on the decline for thirty to sixty days, and steady employment of shop facilities until the end of the year seems to be fairly well assured at this time.

Full Employment Reported

The monthly summary of local conditions issued by the largest bank in Milwaukee says the situation is again one of full employment, following a letdown in the demand for common labor late in June. For a period, covering May, June and July, there was a falling off in bookings of orders by the leading iron, steel and machinery firms, but the trend since Aug. 1 is better. In the automobile, parts and accessories group business has been well maintained, and only in one month since the first of this year has there been a reduction in the payroll numbers of this group. It is also stated that prospects for the foundries and machine shops dependent upon the automobile industry are reported to be exceptionally good.

The local used tool market, while not uncomfortably filled with second-hand equipment, has perhaps more to offer now than in more than a year's time. The liquidation of a number of metal working concerns, several of more than moderate size, is being accomplished without achievement of the aim of keeping them intact, as had been expected, and the result is that the properties are moving into new hands in small lots rather than in bulk.

New York Dealers Optimistic

Two prominent machine tool dealers in New York City had no hesitancy in stating that they expected a full return to the earlier prosperity of this Spring sometime during September and one of them stated that he would set the fifteenth of the month as the starting point for a rush of orders. Meanwhile all dealers in both new and used machinery are consoling themselves with a comparison of figures. Business this August is far ahead of that of the same month last year and is equal and in some cases ahead of July of this year. Every dealer in the Metropolitan district will have a record breaking year in both volume of business and number of sales if business does no better than stays as good as it is at present.

Railroad buying continued this year and the Central of New Jersey R.R. completed purchases on a list recently sent out. The Baltimore & Ohio R.R. also was in the market with a good list and deals were expected to be completed either this week or the first of next.

One big industrial in the Metropolitan district has signified its intention of replacing much of its equipment and, while the name of the concern was not learned, it was understood to be a large one and the amount involved well over $50,000.

Automotive buying has not been up to the anticipated mark, but there have been some few machines bought during the past week and many more are needed in the shops around New York City.

Used machine tools sold well this week and no trouble was found in purchasing in plants that are replacing with new tools.

Busy Fall Expected in Chicago

The past week did not bring any improvement in machine tool sales in the Chicago district. Second-hand machinery is selling fairly well. Dealers in new machinery anticipate an improvement during the next three or four weeks. The Western Electric Co. purchased a few tools during the week and the Elgin, Joliet & Eastern R.R. placed an order for several machine shop tools. The Southern R.R. purchased six machine tools.

Inquiry for pig iron is again extremely quiet in the Chicago district. There have been practically no sales of importance during the last week. Reports of active trading in the Chicago pig iron market which have come from the East are not authentic as selling agencies here report an extremely quiet market with little more than car load lots wanted and few of them. There have been several sales recently as high as 700 tons, but nothing larger than this could be verified. Blast furnaces are still forced to pile a good portion of their product and production is being further curtailed.

There has been a slight reduction in the number of persons employed by the metal trades in the Chicago district but there is demand for skilled workers.

Personals

J. P. MOSES

J. P. MOSES of Joseph T. Ryerson & Son, Inc., Chicago, has just been appointed general manager of railroad sales, with offices in Chicago. He succeeds H. A. GRAY, who has resigned to enter another field of business. Mr. Moses has been with the firm of Joseph T. Ryerson & Son, Inc., for over 22 years and is well known in railway circles.

H. T. BRADLEY, of Jos. T. Ryerson & Son, Inc., Chicago, who has been serving the railroad field for many years in the East, has been appointed manager of Eastern railroad sales with offices in New York City. Mr. Bradley came with the Ryerson company in 1906 and spent a great deal of his time as a sales engineer in the machinery department. For the past seven years, however, he has been associated with the railroad division as assistant manager. He has concentrated his efforts largely on staybolt iron and special railroad machinery.

H. T. BRADLEY

ROBERT L. CRANE, formerly western New York manager for Henry Prentiss & Co., will have charge of the Buffalo office of the newly formed organization, Crane-Schiefer-Owens, Inc., that has taken over the Crane Machinery Co., Buffalo. Mr. Crane was the general manager for the Crane company.

FREDERICK W. SCHIEFER, recently resigned from the Rochester office of Henry Prentiss & Co., New York, will have charge of the Rochester office of Crane-Schiefer-Owens, Inc., recently formed in Buffalo with offices in Buffalo, Rochester and Syracuse.

W. E. CROSS of Clemson Bros., Inc., Middletown, N. Y., recently returned from a four months' trip to Europe. His many interesting experiences were chronicled at some length in the Middletown papers as well as his opinion of business conditions in Europe.

EUGENE L. BEISEL, formerly with the Reeve-Fritts Co., Chicago, will represent Charles H. Besly & Co., Chicago, in New York and Pennsylvania. Mr. Beisel's headquarters will be at 79 Norwalk Ave., Buffalo.

E. E. GAGNON has accepted a position with the Whitman & Barnes Manufacturing Co., Akron, Ohio.

S. R. CUMMINGS has accepted a position as research engineer with the Hoover Suction Sweeper Co., North Canton, Ohio.

JOHN F. CUNNINGHAM, JR., has been appointed assistant manager of the production department of the Schenectady works of the General Electric Co.

N. W. STIRLING has been made president and treasurer of the Stirling Machine & Boiler Co., Jersey City, N. J.

DR. THOMAS ADDISON has retired as Pacific Coast manager of the General Electric Co. and will be succeeded by J. A. CRANSTON, formerly Northwestern manager. Dr. Addison has been with the company for 33 years, and has held his present position since 1892.

A. W. GRAY, works manager of the Billings & Spencer Co., Hartford, Conn., has resigned.

J. H. G. WILLIAMS, assistant works manager and metallurgist of the Billings & Spencer Co., Hartford, Conn., has resigned.

F. E. BALLDA has been appointed assistant to H. C. OVIATT, general mechanical superintendent of the New York, New Haven & Hartford R.R. with headquarters in New Haven.

JOHN REID has been appointed superintendent of the Readville shops of the New York, New Haven & Hartford R.R., succeeding F. E. BALLDA.

WILLIAM HURST has been appointed shop and tool specialist at the Readville shops of the New York, New Haven & Hartford R.R.

ELIJAH WILDES has been appointed general foreman of the Readville shops of the New York, New Haven & Hartford R.R.

T. J. FOLEY has been made supervisor of production of the Readville shops of the New York, New Haven & Hartford R.R.

JOHN B. EMORY has been appointed works manager of McCord & Co., West Pullman, Chicago.

EMORY W. JONES has been appointed district sales representative of the Carborundum Co., Refractory Division, at Perth Amboy, N. J. His territory includes northwestern Pennsylvania, northern Ohio, and part of Michigan. His headquarters will be in Cleveland and Detroit.

JAMES HOLIHAN will be in charge of sales for the General Accessories Co., of Pontiac, Mich., in Detroit. Mr. Holihan was formerly with the Briscoe Manufacturing Co.

M. D. HOPKINS will represent the Max Ams Machine Co., New York, in the Chicago territory. His office will be located at 20 East Jackson Boulevard. Mr. Hopkins was formerly with the Angelus Sanitary Can Machine Co., of Los Angeles, Calif.

GEORGE C. SHADE has resigned as purchasing agent of the Fort Pitt Bridge Works, Canonsburg, Pa.

R. L. CLARK has been made general superintendent of the Billings & Spencer Co., Hartford, Conn.

W. R. CROKE has been made superintendent of the small tools department of the Billings & Spencer Co., Hartford, Conn.

Obituary

GEORGE L. HARVEY died recently in Chicago. Mr. Harvey was an early designer of steel cars and was also the inventor of the Harvey friction draft gear spring.

HENRY B. CARTWRIGHT, formerly district engineer of the Seaboard Air Line with headquarters at Jacksonville, Fla., died recently in that city.

Business Items

The Oilgear Co., Milwaukee, Wis., announces the appointment of the E. A. Kinsey Co., 235 South Meriden St., Indianapolis, as selling agent for Oilgear products of the states of Indiana, Kentucky and Tennessee.

Crane-Schiefer-Owens, Inc., will succeed the Crane Machinery Co., and offices will be established in Buffalo, Rochester and Syracuse.

The fire that destroyed the Newark Baseball Park recently did not damage the buildings of the Driver-Harris Co., Harrison, N. J., situated adjacent to the park, contrary to reports that gained circulation following the fire.

The Florida Screw Machine Products Co. was incorporated in August at Jacksonville, Fla., with $50,000 capital, for the manufacture of machinery and machinery supplies. Officers are M. F. Marshall, president; M. Howell, vice-president; T. Duncan, secretary and treasurer.

The Southern Metal Trades Association, Healey Bldg., Atlanta, is preparing to issue within 60 days its 1924 edition of the Blue Book and Buyers Guide of the metal trades industries of the South, according to an announcement by William E. Dunn, Jr., secretary of the organization. This is the second annual issue, and it will list alphabetically all products manufactured by members of the S.M.T.A., and also contain a complete list of the members throughout the South. It will be distributed to buyers of iron and steel products throughout the country.

Rebuilding of the Shenango Furnace Co.'s machine shop at Sharpsville, Pa., which was damaged by fire a few months ago at a loss of about $50,000, has begun. The company recently purchased its requirement of new machine tools.

A fire in the plant of the Davitt Iron Works, Springfield, Mass., recently, caused about $100,000 loss, including much damage to patterns belonging to several industrial concerns in the vicinity.

According to a recent announcement by Morton Jones, of Asheville, N. C., president of Morton Jones & Co., recently organized and incorporated in that city, the company is planning the early establishment at Asheville of a plant to include foundries and shops, for the manufacture of hot air heating furnaces and accessories.

Transfer of the plant, equipment and other assets of the defunct United States Automatic Gearshift Co., Eau Claire, Wis., to B. R. L'Hommedieu of Madison, Wis., was completed Aug. 20. Preparations are being made to resume operation, although the production of hydraulic units for operating automobile transmission gears will be made subsidiary to general mechanical appliance manufacture. The property was bid in at trustee's sale some time ago by Mr. L'Hommedieu for $41,500.

The Whiting Railway Motor Car Co. was incorporated at Tampa, Fla., with $200,000 capital the latter part of August, for the manufacturre of railway cars. Officers are A. P. Stucky, president; J. A. Whiting, vice-president; and F. W. Brown, secretary and treasurer.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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THE few changes that occurred in the business outlook last week were all for the better. In the gasoline war the heavy artillery bombardment is all over and though a few skirmishers are firing desultory shots the smoke is lifting from the field and it is seen that the carnage will not be great after all. It is doubtful, too, whether any means other than drastic price cutting could have been devised to overcome the effects of the steady accumulation of stocks which has followed the reckless exploitation of the country's oil resources during the past few years. The oil industry, as a whole, has unquestionably brought its troubles down on its own head. What it needs, perhaps, is a general commander such as moving pictures and baseball have, for unless the industry itself can devise a means of overcoming the waste of flush production public demand in years to come will likely insist on the appointment of such a commander in the person of the government.

The "near war" abroad is also probably nearer settlement. It is true that Poincare's answer to the British note showed no intention to compromise, but he has assented to a meeting with Baldwin at which he may be made to understand the exigencies of the moment somewhat better. Private advices from England tell me that the downfall of Poincare in the French elections next November would not be surprising. They say that Paris opinion is not French opinion, and express great doubt that the premier has the wholehearted support with which he is generally credited here. And if the international value of the French franc should decline further his position will be weakened correspondingly. Belgium, of course, is continually on the verge of taking England's side of the controversy, and on the whole it seems that the European outlook in the distance grows brighter. Certainly there is no reason to expect any further dispiriting effect on the American markets.

Coming back home again, some disquietude is being expressed in certain circles over the fact that the "radicals" may hold the balance of power in the next Congress. Nominally the Republicans have a majority of eight in the Senate and of fourteen in the House, but the shift of only five Senators or eight Representatives of the LaFollette-Brookhart school to the minority can effectually counteract President Coolidge's New England conservatism. The difficulties in the Administration's way are obvious, but those who ascribe undue power to the "radicals" forget that there are also conservatives among the Democrats who may be relied on to line up against them.

It has been the history of the United States, both before and since John Stuart Mill made the observation more than sixty years ago that "Americans when confronted by a grave economic question have often seemed upon the point of doing the wrong thing, but in the end the common sense of the people has prevailed and they have done the right thing."

A year ago at this time it seemed that we were doing many "wrong things." We were still in the throes of the railway shopmen's strike. We were just approaching the end of a long and disastrous coal strike which affected the whole country. The prices of farm products were relatively lower than other commodities and wage advances were being granted in many industries. Complaint over high taxes was general and the political pot was boiling furiously. With all these drawbacks industrial production has made great strides and as compared with the previous year it showed gains ranging from 12 per cent in cotton goods to 177 per cent in pig iron.

> "The slight falling off in production and trade since Spring is but necessary leisure for digestion. The business organism gorged itself in the Spring when activity in many lines, notably building and automobiles, reached unprecedented levels. As a result, digestion is proceeding at leisure and without distress and it should be completed soon and normal activity resumed."

Today some business men are bemoaning a decline in production, and sentiment on the whole is less optimistic than it was a year ago. Yet the facts are these: The railroads are free from labor trouble and are carrying the greatest traffic of their history with extraordinary efficiency. There are no important strikes in progress and if the coal strike occurs it will be confined to anthracite; nor will it cause distress until late Winter. This year's crops are more valuable than last year's and the farmer's power to purchase other commodities is greater. The economy enforced on the government has brought taxation relief appreciably nearer. And production in the leading industries during July compared with the excellent showing of a year ago, showed gains ranging from 1 per cent in cotton goods to 50 per cent in pig iron.

The Federal Reserve ratio of 77.9 per cent is virtually as high as a year ago; credit is abundant and money rates are not seriously higher. The slight falling off in production and trade since Spring is but necessary leisure for digestion. The business organism gorged itself in the Spring when activity in many lines, notably building and automobile, reached unprecedented levels. It was just as impossible for business to keep up the pace as it would have been for an individual. Fortunately the warning to let down came in time. It came from distributors in whose memory the lessons of 1920 were fresh. It came before stocks had been piled up to top heavy proportions in the invisible channels of trade when few could have taken account of them. As a result digestion is proceeding at leisure and without distress and it should be completed soon and normal activity resumed.

The specific record of the week includes firmness in stocks and bonds, maintenance of the improvement in grain and livestock prices, a cotton market which held up well under pressure of the early selling in Texas and improved crop prospects, and steadiness in most other commodities. The railroads report that Summer tourist travel is heavier than last year, which tells only part of the story as doubtless the increase in the number traveling by automobile has been much greater. Life insurance sales, another reliable "business barometer" were 18 per cent greater in July than they were a year ago.

The importance of the decline of commodity index numbers is being overstressed in many quarters. It has been partly the result of normal seasonal influences and partly of conditions affecting a few commodities, such as sugar, which were overbought early in the year. From these levels it is just as reasonable to look for a general advance as a continuation of the decline. The heavy sales of gasoline now reported furnish sufficient evidence of the power of low prices to increase consumption. On the whole the fact that prices have receded from their heights is one of the encouraging features of a generally cheerful outlook.

Winnipeg Company Gets Chinese Contract

Contracts for the construction of 1,200 miles of railroad in China, involving an expenditure of about twenty million dollars have been received by the Northern Construction Co., Winnipeg, Man. The new line will extend from Canton to Chengtu and will pass through some difficult country, necessitating the building of tunnels. Local officials of the company expect to go to the Orient in the near future to take charge of the work.

News of Washington Activities

BY PAUL WOOTON

EXPRESSING optimism that resumption of negotiations between the anthracite operators and miners will result in an agreement so that work in the hard coal fields may continue without interruption, but asserting that should there be a failure to do so they will report the facts and fix responsibility and make "appropriate" recommendations to the President, members of the Coal Commission returned to Washington recently from their conferences in New York with operators and miners which brought about an agreement to resume negotiations later.

While the atmosphere of official Washington is hopeful that the crisis in the anthracite situation has passed and that from the reopened negotiations will come, if not an immediate agreement on all points at issue, at least an arrangement by which work will continue without interruption, spokesmen for the Administration have let it be known that plans have been perfected to forward heavy shipments of substitutes for hard coal—bituminous coal and coke—into the anthracite consuming sections should a cessation of operations in the collieries come Sept. 1, or at any date.

Although "a cessation of production of any essential commodity cannot be viewed as a pleasant prospect," to use the words of one high Government official, and it is realized that to provide substitutes would entail longer railroad hauls in many cases, place a strain upon open-top car supply and create other problems, yet the plan, it is felt, will insure the people and the industries of the anthracite-consuming regions against suffering from cold or a shutdown of plants.

The Federal Fuel Distributor, F. R. Wadleigh, will be placed in charge of distribution of substitutes if production of anthracite ceases. The broad powers of the Interstate Commerce Commission will be employed to execute the plan. Mr. Wadleigh's office as Federal Fuel Distributor expires by limitation Sept. 22, but it is pointed out that he can be appointed an agent by the Interstate Commerce Commission, and this will be done if the necessity arises.

For several months, Mr. Wadleigh has been making an especial study of transportation of coal and this, added to his broad experience in fuel matters, it is felt by officials, marks him as the logical authority to place the system of distributing anthracite substitutes in operation if that action becomes necessary.

The National Coal Association, through its president, J. C. Brydon, speaking for the bituminous operators, has offered a plan to the Government of supplying soft coal to the anthracite-consuming areas, with voluntary committees of operators to assist and with traffic experts to aid the distribution, while at the same time agreeing in advance to submit to voluntary price-regulation or supervision by the Federal government. The plan in view by the Government will be a government plan, but it is highly probable that the offer of the bituminous operators will be accepted, should occasion arise, at least in major part.

It is evident that in the event of another deadlock between the anthracite miners and operators at Atlantic City, the Coal Commission will resort to an appeal to public opinion, through a statement which will attempt to fix in the public mind the responsibility for the condition.

President Coolidge has displayed deep interest in the coal situation. He has left efforts to compose the situation in the public interest in the hands of the Coal Commission, but is being kept closely informed as to developments. It was after a conference with the chief executive that the Coal Commission sent telegrams inviting representatives of the miners and operators to meet members of the Commission in New York, a meeting which produced resumption of negotiations.

Attorney General Daugherty, Secretary Hoover, Secretary Weeks and several senators and representatives have conferred with the President regarding the coal situation in the last week.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb....	$0.0337	$0.0337	$0.0278
Cold finished shafting.....	per lb....	0.0428	0.0428	0.0415
Brass rods.....	per lb....	0.1741	0.1825	0.1413
Solder (½ and ¼)	per lb....	0.276	0.276	0.180
Cotton waste...	per lb....	0.1231	0.1231	0.10
Washers, cast iron (⅛ in.)...	per 100 lb.	4.66	4.66	4.06
Emery, disks, cloth, No. 1, 6 in. dia.....	per 100...	3.08	3.08	3.11
Lard cutting oil	per gal...	0.575	0.575	0.575
Machine oil....	per gal...	0.349	0.349	0.36
Belting, leather, medium.....	off list....	37%	37%	46⅔%
Machine bolts up to 1x30 in.	off list....	44¼%	44¼%	59%

International Meeting of Standardizers

A conference of the secretaries of national industrial standardizing bodies was held in Switzerland, July 3 to 7. Thirteen countries were represented, including all of the more important industrial nations of Europe and America. The sessions were held in Zurich and in Baden.

A leading topic discussed by the conference was the interchange of information between the various national bodies during the development of the work in the different countries. At the first conference held in London two years ago, arrangements were made for the systematic interchange of completed work and, to some extent, of information on work in progress. Experience had shown such an early interchange to be extremely important for the work within the different countries from the national viewpoint alone and quite irrespective of the question of international standardization.

While it was not possible to overcome all the difficulties existing by virtue of the important industrial considerations involved, very substantial progress was made. It is believed that the steps taken will lead immediately to a substantially increased amount of interchange of information during the earlier stages of standardization work, and that the way has been paved for a much more extensive interchange in the future.

Provision was made for continuing the work of the conference on the many administrative problems of common interest, through a loose-knit continuing organization. An example of such work planned by the conference is the translation of technical terms of special importance or difficulty in standardization work. There will gradually be built up such a vocabulary of technical terms, mainly in English, French, and German, but supplemented as far as may be feasible and necessary by the corresponding terms in other languages. Another example is the work undertaken by the conference on the classification and nomenclature of standards. The American Engineering Standards Commitee was represented at the conference by P. G. Agnew.

Auto Trade Thrives in Canada

Thriving conditions in the automobile industry in Canada are indicated in a comprehensive report compiled by the Dominion Bureau of Statistics dealing with motor manufacture and export during 1922. The report shows that following the slump in 1921, every branch of the industry began to pick up, and in most cases exceeded the records made in the banner year of 1920.

"The number of automobiles manufactured in Canada during 1922" the report states, "exceeded all previous records, and reached a total of 101,007, or seven per cent more than the maximum production of former years attained in 1920, and 53 per cent more than the output of 1921. The total value of the output was $81,956,429, or $14,906,220 greater than in the preceding year, although $19,509,417 lower than the corresponding figures for 1920."

It is interesting to note the increase in public favor of closed cars, due, in all probability, to the larger number of motorists who are driving cars throughout the Winter. In 1920 the output of coupes was 3,276, and of sedans, 4,681. In 1922 the numbers rose to 5,367 for coupes and 10,431 for sedans. The production of runabouts increased slightly from 3,759 in 1920 to 4,700 in 1922.

Germany's Production Seriously Curtailed

Ruhr occupation is now being felt by industries in all parts of the country—Mark stabilization and its disastrous result—Investing in foreign securities and making big profits

By OUR BERLIN CORRESPONDENT

THE first six months of Ruhr occupation have belied nearly all forecasts pronouncing immediate disaster for industry due to lack of fuel, raw material and the numberless kinds of semi-finished material of which the steel works in the Ruhr are almost the only source of supply. No shortage of any kind has become visible; the string of supply continues unbroken.

But at the beginning of the second half-year a complete change of the situation was evident. Rents in the economic fabric became evident, rapidly increasing in size and numbers until everything seems to approach a state of disorganization and disintegration with chaos close behind. Matters might not have taken this sinister course for a while, but continued in a semblance of order had it not been for the well-meant, but faulty measures of the government. The latter were responsible for the first disaster that befell the industry after the occupation—the business slump, caused by the unfortunate attempt at mark stabilization. The extent of this depression has become evident by its duration long after the mark stabilization had broken down. Just at the time when business commenced to recover from this blow, a second attempt in the same direction, but engineered differently, seems to be breaking industry's backbone completely. The restriction placed upon import caused by the governments' attempt to monopolize the money exchange, dealing out foreign bills in dribs had been in force only a few weeks, when a stringency not only of imported but also of home-produced material made itself felt. Complaints with regard to an insufficient supply of raw material and especially semi-finished products, even of a complete stoppage have been forthcoming in quick succession.

Lack of Raw Material

A number of machine building works had to curtail production at the very beginning of this new development. It is quite clear that the restrictions of import cannot have produced this effect but have only accentuated the approaching exhaustion of the reserves in the country. Naturally this does not apply to products obtained by importation exclusively. The machine building industry scarcely uses such products. A glance into the official statistics shows that the import of such kind of raw material which that industry requires has in the first five months of the year increased only in a small measure, compared with the corresponding period of last year. The exhaustion of reserves marks a highly critical stage in the course of events. Even if ways and means are found to liberate the import business from financial restraint, the import market could not substitute the Ruhr supply of the machine building industry in its entirety. There are numerous brands of material and shapes for which the Ruhr is to the machine building industry the only source of supply in existence.

It was obvious since the Ruhr blockade that a state would be reached sooner or later when the absence of the Ruhr supply must cripple the machine building industry in the German interior. Manufacturers as well as the Government have shut their eyes before this contingency, as the duration of the Ruhr tragedy has generally been underestimated. From all signs, that state of affairs has now arrived. It bears a close resemblance to war times and will no doubt lead to the makeshift methods evolved during the former. The lessons taught in war times are becoming a valuable asset.

If the industry is now more and more becoming dependent on foreign supply, not only of fuel but in nearly every other respect, the important question arises whether there are sufficient means in the country to pay for imports. This question is of a rather complex nature. The financial landslide of recent months is generally ascribed to the largely aggravated state of the trade balance. It is quite clear that a considerable part of the gold funds in the country have gone in exchange of imported goods. It would, however, be an entire misconception of facts to hold the excess of import solely responsible for the present financial calamity. There are other causes of a momentous nature which have sapped the State's life blood in a much larger measure. Foremost amongst them stands the credit system. The enormous inflation of the last months is largely due to the credits extended not only to the industry of the occupied zones, but also to the German interior which have reached gigantic dimensions.

> **"The restriction placed upon imports caused by the government's attempt to monopolize the money exchange, dealing out foreign bills in dribs, had been in force only a few weeks when a stringency not only of imported, but also of home produced material made itself felt. Complaints with regard to an insufficient supply of raw material and semi-finished products have been forthcoming."**

Juggling the Marks

The downslide of the mark had greatly reduced the value of these huge sums. Since the manufacturers are in the habit of investing all available cash in foreign securities thereby keeping its substance intact and then discharge their indebtedness at a much lower mark rate they are heavy gainers under this system. The State treasury, which supplies these securities, moreover at low rates, is equally the loser and the sole loser.

A case which has caused a good deal of public comment may here be quoted as specially illustrative. Shortly after the Ruhr occupation a Rhenish firm of manufacturers of machinery, iron and steel products, credited with huge means applied for and received a loan of 1,000 million marks, for the purpose of keeping its works going. This sum was admittedly invested at once in "value preserving" securities, or to be more distinct in dollars and pound sterlings, which the state bank then supplied at the rate of 20,000 marks to the dollar. Several months later the firm discharged this debt and successfully arranged for a new and much larger one. At that time the mark rate was 500,000 to the dollar. The firm had therefore only to realize 2,000 of the 50,000 dollars it received to pay back their debt, thereby making a net profit of 48,000 dollars. Such cases are not singular but rather typical. It is no exaggeration of facts to say that about a fourth part of the whole population is thriving on this system.

Paper Credit, Gold Cash

The government has now, with great reluctance opened the road to gold credits, but no one wants such as long as a paper mark credit can be had. The latter is, while the mark continues its downslide, a sure road to wealth. Similar conditions exist with regard to the advance payments made to manufacturers, averaging from one-third to one-half of the purchase price. These payments are supposed to enable the manufacturer to buy the material needed and to pay part of the cost of labor. Naturally the manufacturer does not buy material at the receipt of each advance payment and does not pay his workmen for weeks ahead. Instead he does what the recipient of a loan does, invests in foreign securities. The result to the State treasury is identical. The dangerous depletion of the latter is therefore not due to import purchases alone. A large part of its funds have not left the country but have simply changed hands. The hands which received them were chiefly those of manufacturers. These hands are also keeping a firm grip on gold securities as is shown by recent experience.

When dealing out foreign bills for import in small allotments only it was supposed that manufacturers would supply the rest from their own funds. As could be seen they did not do that, but stinted their works with regard to supply rather than part with their gold funds. The only way out of this muddle is doubtless the return to the gold standard for all business transactions. The country is fast approaching this state, after the stabilization of wages has cleared the road. This does not necessarily mean the abandonment of the paper mark, although it will precipitate its ultimate fate. The strain of the financial situation would doubtless not have been as great had it not been for the diminution of export which

deprived the State of a considerable part of its gold revenue.

It will be remembered that exporters have to surrender part of the foreign bills they receive from export to the Government in exchange for paper marks. This part which was at first 25 per cent has lately been increased to 40 and 50 per cent. The drop of export was chiefly due to the conditions in the Ruhr and the other occupied parts where shipping is practically paralyzed, and also in a measure to the depression of the export business in the interior, following the mark stabilization in February.

The machine building industry is effected less strongly. From January to May, 138,818 tons of machinery have been exported as against 187,387 tons in the corresponding period of 1922.

The deficit has been accumulated during the last two months of the period mentioned and is heard to have further increased in the consecutive months for which authentic figures are not yet available. The May shipments of 24,600 tons were 40 per cent below last year's monthly average.

The import of machine tools in May kept within narrow limits. Except 13 tons coming from Austria and 6 tons from other countries not specified, all in all 41 pieces, no imports are recorded. The monthly average of 1922 was 108 tons or 120 units. The total of imports from January to May 1923 was 307 tons or 344 pieces compared with 542 tons or 639 pieces in the corresponding period of the preceding year.

Cost of Living Shows Slight Increase

The cost of living in the United States on July 15, 1923, was 61.9 per cent higher than in July, 1914, according to the results of a comprehensive investigation just completed by the National Industrial Conference Board. Between June 15 and July 15, 1923, there was an increase of 1.8 points or 1.1 per cent. This was brought about by continued advances in the cost of food and clothing and further increases in rents. Fuel prices were a little lower, while average sundries and light charges remained unchanged. Between July, 1920, when the peak of the rise in the cost of living since 1914 was reached, and July, 1923, the cost of living dropped 42.6 points or 20.8 per cent. Within this three-year period a number of shifts in costs occurred. Food and clothing prices and the average cost of all sundries combined were lower in 1923 than in 1920. Rents, on the other hand, in 1923 were at the highest average yet reached for the country as a whole. Coal prices, after mounting much higher during the Winter of 1922-1923, in July, 1923, were at the same level as in July, 1920.

Maxwell Motors Shows Large Profits

The Maxwell Motors Corp. and its subsidiaries for the six months ended June 30, 1923, reports net profits of $3,072,531, an amount in excess of the total profits for the full years 1919, 1920 and 1922. The net profit is calculated after provision for taxes, insurance, depreciation and interest charges.

Record for Locomotive Deliveries

Seven new locomotives on the average were placed in service on railroads throughout the United States for every day of the first seven months this year, according to figures made public by the Department of Commerce. This report states that 1,543 new locomotives had been delivered to the railroads of the United States from the principal locomotive works.

The vastness of the new motive power is more significant when it is considered that during the same period of last year there were only 342 new locomotives delivered to the railroads in the United States. But even there, railroad men point out, the comparison should not stop. The report of the Department of Commerce shows that 1,652 new engines were either under construction or on order on Aug. 1 of this year. Should these locomotives be delivered during the remainder of the year the total for the year would be close to 3,200.

Freight Record Lowered by Harding Funeral

Loadings of revenue freight for the week ended Aug. 11, totaled 973,162 cars, according to the American Railway Association. This decrease of 59,968 cars under the week of Aug. 4, was largely due, the report states, to the observance of President Harding's funeral.

Although the loadings were under the previous week, they still remained 130,472 cars over the same week of 1922 and 164,893 cars more than were loaded in the corresponding week of 1921.

Merchandise and miscellaneous freight, which are taken as an indication of manufacturing conditions throughout the United States, totaled 550,746 cars. This was a decrease of 34,442 cars under the previous week, but an increase of 10,221 cars over the corresponding week of last year, as well as 69,268 cars over the same week of 1921.

Will Wage Warfare on Accidents

Capital and labor, at the earnest solicitation of Governor Alfred E. Smith and State Industrial Commissioner Bernard L. Shientag, of New York State, have joined hands in the first comprehensive movement to cut down industrial accidents in New York State, now totaling about 300,000 each year with an average of 1,300 fatalities. The employers and the workers who are in the vanguard of the crusade are to have the active help of civic and welfare organizations, and every available agency will be used to carry the message of safety to the industrial establishments of the State.

The first move in the campaign to reduce this annual toll of economic wastage and human suffering was the conference held a few days ago at the State Labor Department's headquarters in New York City. At this meeting, which drew together several hundred men and women, many known nationally for their activities along commercial, industrial and welfare lines, it was decided to form an educational council to cooperate with the Labor Department in the campaign and to divide the State into six districts in order that the most intensive sort of crusade may be carried on. Headquarters of these six districts, which will operate under the direction of the council or central committee, will be in New York, Albany, Binghamton, Syracuse, Rochester and Buffalo.

Hayes Wheel Co. Shows Good Profit

The Hayes Wheel Co., Jackson, Mich., wood and wire wheels and wheel parts, for the first six months of the current year reports gross sales of $9,672,812 as compared with $6,155,431 in the corresponding period of 1922. Net profits for the first half of 1923 are shown as $900,026, against $510,331 in the first six months of last year.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Automobile accessories. Aarau, Switzerland. Purchase and agency. Reference No. 7509.

Automobile frames, transmissions, differentials, and front and rear axles. Posen, Poland. Purchase. Reference No. 7511.

Steel ball bearings. Johannesburg, South Africa. Purchase. Reference No. 7496.

Ebonite manufacturing machinery such as horizontal jacketed vulcanizing pans and grinding and mixing machinery. Croyden, England. Purchase. Reference No. 7510.

Forthcoming Meetings

International Railway General Foremen's Association. Annual convention. Hotel Sherman, Chicago, Ill., Sept. 4, 5, 6 and 7. William Hall, secretary, 1061 W. Wabash Ave., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Third annual machine tool exhibit Sept. 18, 19, 20 and 21. Mason Laboratory, New Haven, Conn. A. C. Jewett, chairman.

Association of Iron and Steel Electrical Engineers. Iron and steel exposition, Buffalo, Sept. 24 to 28. John F. Kelly, secretary, Association of Iron & Steel Electrical Engineers, 708 Empire Building, Pittsburgh, Pa.

National Safety Council. Twelfth annual congress at Buffalo, N. Y., Oct. 1 to 5. All meetings will be held at the Statler Hotel. Headquarters, 168 No. Michigan Ave., Chicago, Ill.

American Society for Steel Treating. Annual convention at Pittsburgh in connection with the International Steel Exposition, Oct. 8, 9, 10, 11 and 12. W. H. Eisenman, 4600 Prospect Ave., Cleveland, Ohio, national secretary.

Society of Automotive Engineers. Production meeting at Cleveland, Ohio, Oct. 25 and 26. Headquarters, 29 West 39th St., New York City.

American Management Association. October 29, 30, and 31, Hotel Astor, New York City.

National Exposition of Power and Mechanical Engineering. Second annual exposition to be held at the Grand Central Palace, New York City, Dec. 3 to 8. Headquarters. Grand Central Palace, New York City.

New and Enlarged Shops

Machine Tools Wanted

Colo., Lamar—E. D. Draper (plumber)—pipe threader.

Colo., Lamar—Golloday & Watson—automobile cylinder grinder.

Colo., Lamar—North Side Battery Shop, 101 North Main—lathe.

Ill., Rockford — G. Watson, 520 Brown Block—18 to 22 in. drill press, electric drill and air compressor.

Kan., Johnson City—H. Berman—lathe, drill press, emery stand, belting and hangers for garage.

Kan., Wichita—West Side Garage, 300 West Douglas Ave.—lathe and arbor press.

Mass., Boston—Basil & Hutchins, Tremont and Camden Sts.—lathe, planer, upright drill, hack saw, pipe and bolt threading machine, shafting, pulleys, belting, also small tools for proposed $50,000 garage.

Mich., Niles—Natl. Standard Co.—complete machinery for the manufacture of beads, air compressors, automobile and railroad jacks, for new plant at Akron, O.

Mo., St. Louis—L. Grohe, 2416 Menard St.—lathes, drills, emery wheels and general equipment for automobile repair shop and garage.

Mo., St. Louis — A. J. Ickenroth, 1012 Yale Ave.—lathe, presses and other general equipment for garage at 6808 Clayton Ave.

Mo., St. Louis—Natl. Metal Trades Assn., 414 Odd Fellows Bldg. (metal working)—medium size drill press.

Mo., St. Louis—D. Wolff & Sons, 2219 South 4th St. (machinery)—lathe, drill press, belting, etc.

N. Y., New York—Pavan Garage, 104 East 126th St.—lathes and miscellaneous tools for garage.

N. C., Winston-Salem—Lindsay-Fiskel-Buick Co.—reamer and burning in machine.

O, Columbus—Acme Motor Truck Sales Co., 171 South Front St., L. Bock, Service Mgr.—grinder, milling machine, etc.

O., Dayton—Recording Devices Co., 5th and Norwood Sts.—about 200 machine tools for the manufacture of automobile parts and accessories

Pa., Vienna (Coon Island P. O.) — J. Sheasley & N. Pound—equipment for garage and repair shop.

Tenn., Knoxville — Duncan Mchy. Co., P. O. Box 265—8 ft. engine lathe, 24 in. swing.

Va., Radford—Radford Motor Co.—lathe, drill press and bench tools.

Va., Richmond—Acme Auto Service Co., 902 Hull St.—drill press.

Va., Richmond—D. T. Burch, 2043 West Broad St.—reamer and burning in machine.

Va., Richmond—H. K. Dabney, 1831 West Broad St. (automobile repairing)—reamer.

Va., Richmond—Franklin & Studebaker Service Sta., 1621 West Broad St.—lathe and drill press.

Va., Richmond—Fulton & Barnes, 1643 West Broad St.—drill press for automobile repairing.

Va., Richmond—A. R. Hall, 1623 West Broad St.—shaper for automobile repair shop.

Va., Richmond—H. T. Holt, 717 Hull St.—lathe, drill press and grinding in machine for automobile repairing.

Va., Richmond — C. Long, 1011 West Broad St.—drill press for automobile repairing.

Va., Richmond—G. B. Nichols, 903 Hull St.—drill press and tinner's tools.

Va., Richmond — C. G. Reynolds, 1209 West Broad St.—drill press and emery wheel for automobile repairing.

Va., Richmond—Richmond Typewriter Exchange, 24 North 7th St.—small lathe.

W. Va., Bluefield—Kirk Motor Co., E. S. Kirkpatrick, Mgr.—lathe, bench tools, etc.

W. Va., Logan—Guyan Machine Shop—cylinder grinder for automobile repair work; slitting shear and punch for ½ in. plate; 250 ton hydraulic wheel press.

Wis., Fair Water—C. Kuehn (machinist)—medium size lathe, 20 in. drill press, emery stands and air compressor, to replace that which was destroyed by fire.

Wis., La Crosse—F. Miller, 433 Avon St.—automobile repair machinery, gasoline tanks and pumps for proposed service station and garage.

Wis., Milwaukee—Heating & Power Appliance Co., 200 Pleasant St.—one engine lathe, 16 to 18 in. swing.

Wis., Neenah—Wisconsin River Paper & Pulp Co., 201 West Wisconsin Ave.—pipe threading machine for pipe up to 6 in. diameter for plant at Stevens Point.

Que., Coteau du Lac—A. Tremblay—complete garage and repair shop equipment.

Que., Hemmingford — Millars Garage — automobile repair equipment.

Que., Knowlton—N. H. Robinson—repair equipment for garage.

Que., La Tuque—J. P. Simard—garage and repair equipment.

Que., Laurierville — Garage Couture, C. Couture, Purch. Agt.—automobile repair shop equipment.

Que., Loretteville—G. P. Riout—machine tools for garage.

Que., Mansonville—J. A. Roberge (garage)—shaper, borer, etc., also machine for pressing wheels.

Que., Marieville—C. E. Prefontaine—automobile repair equipment.

Que., Nicolet—N. Lafond—automobile repair shop equipment.

Que., Ormstown—C. A. Anderson—garage and repair equipment.

Que., Paspebiac—J. E. Levesque—complete automobile repair shop equipment.

Que., Pierreville—Houle & Frere—automobile repair shop equipment.

Que., Quebec—P. Moisau, 926 Rue St. Valier — machine and blacksmith shop equipment.

Que., Roxton Pond—H. Ballard—automobile repair equipment.

Que., St. Bernabe Nord—O. Charbonneau (blacksmith)—machine shop equipment.

Que., St. Chrysostome — M. Struthers (blacksmith)—threading machine and other tools.

Machinery Wanted

Colo., Lamar—Brown Lumber Co., 400 North Main St., J. H. Brown, Purch. Agt.—large size wood lathe for planing mill.

Colo., Lamar — F. H. Friend, Ben-Mar Annex (job printer)—job press and Miller feeder.

Colo., Lamar—C. A. Hansen, Main St.—job press and paper cutter.

Colo., Lamar—Lamar Register, Main St., G. B. Merrill, Purch. Agt.—paper cutter.

Colo., Lamar — Lamar Sparks — 30 in. paper cutter.

Colo., Lamar—Meyer Lumber Co.—wood sander.

Ga, Chipley—J. Stout—Chandler & Price job printing press and wire stitcher.

Ga., Rockmart—Printer, Box 223—linotype machine.

Ill., Chicago—International Linen Co., 169 North Franklin St.—large flax gins, 30 ton pulping plant and one mechanical dryer.

Ill., Herrin—News—rotary press.

Ill., Rockford—Standard Dairy Co., 1532 2nd Ave.—refrigeration machinery, one large power churn and pasteurization equipment.

Ill., Sorento—Home Bakery Co.—dough mixer from 1 to 1½ bbl. capacity.

Ind., Kokomo—Job Shop, Box 602—job press.

Ind., Milton—Bd. Educ.—manual training equipment, including lathes for new $100,000 school.

Ind., Windfall—J. C. Day—9 x 12 in. or 10 x 15 in. job printing press.

Ia., Charlotte—J. Gault—large job printing press.

Kan., Hoisington—R. Cornelius (newspaper and job printer)—saw and trimmer.

Kan., Pittsburgh—Baxter Lumber & Mercantile Co., A. Baxter, Purch. Agt.—machinery.

Kan., Syracuse—E. E. Ellison (leather and harness shop)—finisher and stitcher.

Ky., Louisville—Gray-Von Almen Co., 431 West Oak St.—equipment for handling and testing milk, also refrigeration system for creamery at Bardstown.

Ky., Newport—Newport Rolling Mill Co.—54 in. roller leveler with roller diameter of 3¾ in.

Ky., Paducah—Magle Packing Co.—ice making and refrigerating machinery for proposed $75,000 meat packing plant.

Ky., Paducah—Printer, Box 109—25 x 38 in. cylinder press.

Mass., Boston—Merchants Terminal Co., c/o Monks & Johnson, Engrs., 99 Chauncey St.—conveying machinery for new warehouse.

Mass., Boston—New Method Die Co., 100 Sudbury St.—varnishing machine; booth and dry racks for paper and cardboard; medium size suction fan with motor; medium size air compressor with motor.

Mass., Milford—Hopedale Mfg. Co. (manufacturer of textile machinery), address purchasing department—equipment, including furnaces, ventilating system, conveying machinery, scales, etc., for new $50,000 foundry.

Mass., Needham (Boston P. O.)—School Com.—manual training equipment, including large and small wood and metal working tools, pulleys, shafting, belting, etc., for new high school.

Mass., Sea View—Millcraft Shops (woodworking and pattern making), address the manager—14 in. bandsaw (used).

Minn., Proctor—Job Printer, Box 322—job press.

Minn., Staples—E. D. Lum—newspaper press (used), belting, hangers, pulleys, shafting and linotype.

Mo., Cowgill—News—cylinder press.

Mo., St. Louis — L. Morris, 5602 Etzel Ave.—two pumps, two tanks, compressed air tanks and other general equipment for automobile service station on Julian St. and Page Blvd.

Neb., Omaha—Bee Publishing Co., 17th and Farnam Sts.—combined jig saw, drilling machine, 24 x 36 in. friction drive table and curve plate router.

N. Y., Brooklyn — Bethlehem Knitting Mills, 298 Graham Ave.—Wildman cylinders and dials, 6 cut, 12 to 16 in. size.

N. Y., Buffalo—Amer. Brass Co., 446 Military Rd., W. Bartlett, Purch. Agt.—equipment for steel casting shop.

N. Y., Jamestown—Standard Table Co., 92 Steele St. (manufacturer of furniture), L. G. Cowing, Secy.—woodworking machinery, spray machines, lathes, hand tools, shafting, hangers, pulleys, etc.

N. Y., Long Island City—Cornellist Textile Corp., 45 Jamaica Ave.—brushing machine for pile fabrics, 72 in. wide, 4 brushes (used); one set dry cans, 72 in uprights.

N. Y., Medina—J. C. Pesson & C. W. Grinnell—chemical machinery for proposed $50,000 cold storage plant, to replace that which was destroyed by fire.

N. Y., New York—Harlem Metal Corp., 502 East 133rd St.—miscellaneous metal working machinery.

N. C., Durham—Morven Cotton Mills Co.—machinery for addition to plant.

N. C., Norwood—Norwood Mfg. Co.—textile machinery to increase capacity of plant.

O., Cincinnati—The Cincinnati River-Rail Transfer Co., Front and Harriet Sts.—electrically operated hoists, etc., for proposed freight terminal.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

The markets remain steady except for a half-cent decline in prices of certain metal products in New York. In the same city linseed oil dropped 7c., while lead and zinc rose.

The American Sheet and Tin Plate Co. has announced its prices for the fourth quarter, and there are no changes. Blue annealed sheets will be continued at 3c. per lb., black sheets at 3.85c., galvanized at 5c. This company is reported to have sufficient orders on its books to keep busy for the rest of the year, but a number of independents are in a position to accept orders.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$28.55
Northern Basic	28.77
Southern Ohio No. 2	28.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	34.25
BIRMINGHAM	
No. 2 Foundry	25.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	27.76
Virginia No. 2	32.17
Basic	26.76
Grey Forge	26.76
CHICAGO	
No. 2 Foundry local	28.61
No. 2 Foundry, Southern (silicon 2.25@2.75)	30.51
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	27.77
Basic	26.77
Bessemer	28.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.75
Cleveland	6.75@7.40
Cincinnati	7.50
New York	5.50@7.00
Chicago	5.00@5.50

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	3.00	4.59	3.75	4.15
No. 12	3.10	4.64	3.80	4.20
No. 14	3.20	4.69	3.85	4.25
No. 16	3.40	4.79	3.95	4.35
Black				
Nos. 17 and 21.	3.70	4.95	4.45	5.05
Nos. 22 and 24.	3.75	5.00	4.50	5.05
Nos. 25 and 26.	3.80	5.05	4.55	5.10
No. 28	3.85	5.15	4.65	5.20

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	4.00	5.15	4.70	5.35
Nos. 12 and 14.	4.10	5.25	4.80	5.45
Nos. 17 and 21.	4.40	5.55	5.10	5.75
Nos. 22 and 24.	4.55	5.70	5.25	5.90
No. 26	4.70	5.85	5.50	6.05
No. 28	5.00	6.15	5.80	6.35

WROUGHT PIPE (Welded)—The following mill discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Steel Black	Steel Galv.	Iron Inches	Iron Black	Iron Galv
BUTT WELD					
1 to 3	62	50½	⅜ to 1¼	30	13
LAP WELD					
2	55	43½	2	23	7
2½ to 6	59	47½	2½ to 4	26	11
7 and 8	56	43½	4½ to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1¼	60	49½	⅜ to 1¼	30	14
2 and 3	61	50½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded.	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 15%. Cast iron, standard sizes, 17½% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	8.00	8.00	6.55
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	5.80	5.66	5.80
Cold finished shafting or screw	4.40	3.90	4.55
Cold finished flats, squares	4.90	4.40	5.05
Structural shapes (base)	3.64	3.46	3.40
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.25 at mill)	3.54	3.36	3.20
Carbon tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 5/32, 8.35c.; 1/8, 7.85c.; 5/32 to 1/4, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.00
Tin, 5-ton lots, New York			40.50
Lead (up to carlots), St. Louis	6.50	New York	7.25
Zinc (up to carlots), St. Louis	6.20	New York	7.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	26.10	27.00	28.00
Antimony (Chinese), ton spot	8.25	10.50	8.75
Copper sheets, base	23.25	22.50@23.00	23.00
Copper wire (l.c.l.)	16.50	19.75	16.25
Copper bars (l.c.l.)	20.75	23.00	19.50
Copper tubing (l.c.l.)	25.50	28.00	23.00
Brass sheets (l.c.l.)	18.50	23.00	18.75
Brass tubing (l.c.l.)	24.00	28.50	20.50
Brass rods (l. c. l.)	16.75	19.25	15.75
Brass wire (l. c. l.)	19.00	23.00	.....
Zinc sheets (casks)	10.50	10.45	.....
Solder (½ and ½), (case lots)	29.50	27.75	20.00
Babbitt metal (83% tin)	52.00	49.00	38.00
Babbitt metal (35% tin)	25.00	17.00	16.00
Nickel (ingot and shot)	29.00	.....	35 00
Nickel (electrolytic)	32.00	.....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00
Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	11.50	12 00
Copper, heavy, and wire	11.50	11.00	11.25
Copper, light, and bottoms	10.00	9.00	10.00
Lead, heavy	5.00	5.00	5.50
Lead, tea	4.00	4.00	4.50
Brass, heavy, yellow	7.50	....	7.00
Brass, heavy, red	9.50	9.50	9.00
Brass, light	6.00	5.00	6.25
No. 1 yellow brass turnings	7.00	6.00	6.75
Zinc	3.75	3.00	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$19.50	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.00	17.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	12.60	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7 40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.11
Cotton waste, colored, per lb.	.08@.13	.12	.08
Wiping cloths, 13½x13½, per lb.	10.25	36.00 per M	.10
Wiping cloths, 13½x20½, per lb.	....	52.00 per M	.13
Sal soda, per 100 lb.	1.65	2.25	2.65
Roll sulphur, per 100 lb.	3.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.98	1.18	1.14
White lead, dry or in oil	100 lb. kegs.	New York, 14.00	
Red lead, dry	100 lb. kegs.	New York, 14.00	
Red lead, in oil	100 lb. kegs.	New York, 15.50	
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton	$4.00@4.50	
Coke, prompt foundry, Connellsville	per net ton	5.25@5.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	30%	50-10%	45-5%
1½ and 1½x3 in. up to 12 in.	15%	50%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	15%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	20%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65-5%
Lag screws, coach screws	30%	.....	60-5%
Square and hex. head cap screws	60%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	25%	45%	40-5%
Bolt ends, with hot pressed nuts	30%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, ⅜ and smaller	60%	.....	....
Semi-finished nuts, ½ and larger	55%	65-10%	80%
Case-hardened nuts	40%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.50
Washers, cast iron, in., per 100 lb. (net)	5.50	4.00	3 50
Washers, round plate, per 100 lb. Off list	1.50	4.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, hot pressed, hex., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, sq., per 100 lb. Off list	List net	2.75	2.50
Nuts, cold punched, hex., per 100 lb. Off list	List net	2.75	2.50
Rivets:			
Rivets, ⅞ in. dia. and smaller	40%	50-10%	60%
Rivets, tinned	40%	50-10%	4½c. net
Button heads ⅜-in., ½-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.50	$3 90	$3.75
Cone heads, ditto (net)	5.60	4.00	3.85
1½ to 1½-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.297	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	30-10%	30-10%	30-10%
Heavy grade	20-5-2½	30%	20-5-2½%
Rubber and duck:			
First grade	50-10-5%	50-10%	40-10%
Second grade	60-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.73	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20

O., Wellston — Wellston Mfg. C.—5 ton electric traveling crane, 28 to 40 ft. span.

Okla., McAlester—Guardian—perforator.

Pa., Cheswick—Peerless Sand Co.—conveyors, loaders, complete sand and sand blasting machinery, to replace that which was destroyed by fire.

Pa., Phila.—H. A. Dreer, Inc., 711 Chestnut St.—mechanical equipment, including conveyors, for proposed $175,000 seed warehouse.

S. D., Claremont—A. T. Cox—14 x 22 in. job printing press.

Tenn., Medina—J. W. McCaslin (woodworking)—scroll saw and spindle shaper on Barnes combination machines.

Tex., Marlin—J. A. Keigwin—10 x 15 in. job printing press.

Va., Norfolk—Taylor-Parker Co., Water St. and Commerce Pl.—complete veneering machinery.

Wis., Knellsville (Belgium P. O.)—Farmers' Co-operative Dairy Co., c/o J. Schmidt—vats, separators, belting and shafting for proposed $40,000 cheese factory.

Wis., Madison—G. J. Fessler, 2037 Winnebago St.—band and circular saws.

Wis., Medford—O. H. Maurer—woodworking machinery, lathes, mortiser, planer, etc., for proposed $50,000 sash and door factory.

Wis., Milwaukee—Brusky & Krofcheck, 949 28th Ave., F. J. Brusky, Purch. Agt.—one combination woodworking machine to include 4 operations.

Wis., North Milwaukee—Scholtka Bros., 36th St. and Wallace Ave. (carpentry and woodwork), W. Scholtka, Purch. Agt.—one band saw, size 20 to 30 in., also one small joiner.

Wis., Watertown—Perfection Table Slide Co., 603 Clyman St., W. C. Schultz, Purch. Agt.—6 in. jointer, large cutoff saw, 4 in. sticker, rip saw, mortiser, boring machine and surfacer.

Man., Winnepeg—Winnepeg Hydro-Electric System, 55 Princess St., C. J. Brown, City Clk.—electric traveling crane, capacity of main hoist 25 tons.

Ont., Arkona—High Pressure Oil & Gas Co.—drilling equipment, etc.

Ont., Listowel — Blackmore Hamilton Furniture Co.—$25,000 worth of machinery and equipment.

Ont., Penetanguishene — International Fibre Wks. — machinery to replace that which was destroyed by fire.

Que., Beloeil Village—A. P. Dion—forge and other blacksmith shop equipment.

Que., Beloeil Village—E. M. L'Heureux—sawmill equipment.

Que., Beloeil Village—J. M. Perreault—machinery for sash and door factory.

Que., La Presentation — L. Germain — forge and other blacksmith shop equipment.

Que., Montreal—Autogenous Welding Co., 121 St. Augustin St.—welding equipment.

Que., Montreal—C. P. Fabien & Co., Ltd., 31 St. Cunegonde St. (manufacturer of refrigerators)—woodworking machinery.

Que., Montreal—Montreal Blue Print Co., 209 Beaver Hall Hill—blue printing equipment.

Que., Montreal—Montreal Welding Co., 563 St. Timothee St.—welding equipment.

Que., Montreal East—Red Star Refinery Co., Ltd.—oil filtering equipment.

Que., St. Bruno—A. Guilbert — sawmill equipment.

Que., St. Chrysostome—T. Brisbin—sawmill equipment.

Que., Varennes — P. Choquette — anvil, forge and small tools for blacksmith shop.

Nfld., Twillingate—Notre Dame Herring Oil Co.—reducing, refining and cooperage equipment for plant, capacity 100,000 ton per year.

Germany, Berlin—Bohn & Bormann—equipment for the manufacture of bicycle spokes of type known as double thick end; also machine for the manufacture of nipples. It is reported that this firm pays a deposit at time of placing order and balance before machines have left manufacturer's plant, all in American dollars.

Metal Working Shops

Calif., Oakland—H. L. McCoy, c/o A. W. Smith, Archt., 1010 Bway., awarded the contract for the construction of a 1 story garage on 8th Ave. and East 12th St. Estimated cost $40,000.

Calif., Oakland—W. E. Travis, 366 14th St. awarded the contract for the construction of a 1 story shop and garage on Market St. near 21st St. Estimated cost $65,000.

Calif., Oakland—The L. A. Young Industries, Inc., 9200 Russell St., Detroit, Mich., manufacturer of automobile seat springs and power machinery, has purchased site and plans to build a group of 2 story factory buildings on 73rd Ave., here. Cost will exceed $75,000.

Calif., Pittsburgh—The Trucson Steel Co., 709 Mission St., San Francisco, plans to build a factory, here. Cost will exceed $40,000.

Calif., Sacramento—The Ochsner Estate, Ochsner Bldg., awarded the contract for the construction of a 1 story garage and salesroom on 14th and K Sts. Estimated cost $40,000. Reo Motor Co. of California, 1309 K St., Sacramento, lessee. Noted July 19.

Calif., Sacramento—The Sacramento Pipe Wks., R St. near 7th St., awarded the contract for the construction of a 1 story factory for the manufacture of pipe, on 16th and North B Sts. Estimated cost $40,000. Noted Dec. 14, 1922.

Calif., San Francisco—Morrow & Garren, Archts., Chronicle Bldg., are receiving bids for steel for the construction of a 1 story foundry for the Great Western Smelting & Refining Co., Spear and Folsom Sts. Bids on balance of the work will be taken shortly. Estimated cost $70,000. Noted Aug. 16.

Calif., San Francisco—J. Pasqualetti, 785 Market St., awarded the contract for the construction of a 2 story garage on Bush St. near Franklin St. Estimated cost $40,000.

Calif., Woodland—The Woodland High School Dist. is having plans prepared for the construction of 1 story manual training shops, 200 ft. long. Estimated cost $30,000. W. H. Weeks, 369 Pine St., San Francisco, Archt.

Conn., Middletown—Wilcox, Crittenden & Co., 3 South Main St., manufacturer of marine and awning hardware, are having plans prepared for the construction of a 3 story, 60 x 60 ft. factory. Cost will exceed $40,000. Private plans.

Conn., New London—S. Sulman, 55 Sumner St., is having plans prepared for the construction of a 1 story, 60 x 90 ft. garage on Church St. Estimated cost $40,000. F. De Grange, 28 Ocean Ave., New London, Archt.

Conn., Waterbury—The Bristol Co., Platts Mills, manufacturer of recording instruments, steel belt lacing, etc., awarded the contract for the construction of a 1 story, 50 x 100 ft. factory. Estimated to cost $50,000.

Ill., Chicago — S. Skobel, 802 Windsor Ave., is having plans prepared for the construction of a 2 story, 80 x 190 ft. garage and automobile sales room at 4628 Clifton Ave. Estimated cost $80,000. D. D. Meredith, 4750 Sheridan Rd., Archt.

Ind., Muncie—The Muncie Malleable Fdry. Co., Highland Ave., plans to build a 1 story, 70 x 100 ft. addition to its plant. Estimated cost $40,000.

Ia., Knoxville—The Quartermaster General, Wash., D. C., will soon award the contract for the construction of a garage, etc., for the United States Veterans' Hospital No. 57, here. Estimated cost $79,800.

Ia., Riceville—The Riceville Oil Co. is having plans prepared for the construction of a 1 story, 36 x 154 ft. garage. Estimated cost $45,000. G. L. Lockhart, 1353 University Ave., St. Paul, Minn., Archt.

La., Shreveport—The Kansas City Southern R.R. Co., 11th and Wyandotte Sts., is having plans prepared for the construction of a car repair shop, here, to replace the one which was recently destroyed by fire. Estimated cost $175,000. A. N. Reese, Ch. Engr.

Mass., Boston—Basil & Hutchins, Tremont and Camden Sts., awarded the contract for the construction of a 1 story, 59 x 184 ft. garage on Columbus Ave. Estimated cost $50,000.

Mich., Detroit — F. E. Bromley, 2642 East Grand Blvd., awarded the contract for the construction of a 1 story, 120 x 340 ft. assembly plant for auto trucks on Christopher Ave.

Mich., Detroit—The Hudson Motor Co., Jefferson Ave., awarded the contract for the construction of a 1 story, 65 x 280 ft. addition to automobile factory on Connors Ave.

Mich., Marquette—N. A. Nelson, Archt., Ironwood, is receiving bids for the construction of a 2 story, 70 x 124 ft. garage for E. W. Cork, here. Estimated cost $65,000.

Mo., St. Louis—H. M. Bixby, State Natl. Bank Bldg., will build a 2 story, 95 x100 ft. automobile shop on Maryland St. Estimated cost $75,000.

Mo., St. Louis—The Roxana Petroleum Co., Arcade Bldg., is having plans prepared for the construction of forty gasoline service stations. Cost between $350,000 and $1,000,000. Private plans.

N. Y., Albany—The Albany Garage Co., 28 Howard St., is having plans prepared for the construction of a 5 story, 75 x 120 ft. garage on Howard St. Estimated cost $300,000. T. L. Gleason, 45 Marden Lane, Albany, Engr. and Archt.

N. Y., Albany—The International Harvester Co. of America, 960 Bway, is having plans prepared for the construction of a 2 story, 60 x 210 ft. garage and service station addition to warehouse. Estimated cost $75,000.

N. Y., Brooklyn—Murray & Mauceri, c/o A. Goldberg, Engr. and Archt., 164 Montague St., will build a 1 story garage on Knickerbocker Ave. Estimated cost $50,000.

N. Y., Brooklyn—The Sterling Constr. Co., c/o M. Klein, Engr. and Archt., 37 Graham Ave., will build a 1 story garage on 54th St. Estimated cost $50,000.

N. Y., Buffalo—The Houde Eng. Corp., 1392 West Ave., has purchased site and plans to build a factory for the manufacture of castings, etc., on Northland Ave. Cost will exceed $75,000.

N. Y., Elmira—The Amer. La France Fire Engine Co. awarded the contract for the construction of 2 story additions to its plant. Estimated cost $75,000.

N. Y., New York—The city, G. A. Whalen, Comr. of Plant and Structures, will soon award the contract for the construction of foundations for a motor repair shop on 16th St. and Ave. C.

N. Y., New York — I. Schwab, c/o C. Schaefer, Jr., Engr. and Archt., 394 East 150th St., is having plans prepared for the construction of a 1 story, 100 x 100 ft. garage on West 158th St. Estimated cost $50,000.

N. Y., New York—The Transit Comn., 49 Lafayette St., will receive bids until Sept. 10 for the construction of addition to shops on Lenox Ave. and 148th St. City Eng. Dept., Engrs.

N. Y., New York—M. Wertheim, c/o Meiser & Uffner, Engrs. and Archts, 501 East Tremont Ave., is having plans prepared for the construction of a 2 story 100 x 145 ft. garage on Bradhurst Ave. Estimated cost $100,000.

O., Cleveland — Ormiston Bros., 2708 Franklin Ave. (sheet metal), have had plans prepared for the construction of a 2 story, 65 x 65 ft. factory at 2487 West 25th St. Estimated cost $40,000. Private plans.

O., Cleveland — The Standard Oil Co., East Ohio Gas Bldg., awarded the contract for the construction of a 1 story, 58 x 60 ft. and 24 x 24 ft. garage and pump house on Berea Rd.; also a 1 story, 28 x 80 ft. and 32 x 92 ft. garage, pump house, etc., on Babbitt Rd. Estimated cost $40,000 and $50,000 respectively. J. H. Watterson, Constr. Mgr. Noted Aug. 16.

O., Steubenville—The Standard Oil Co. of Ohio, c/o J. H. Watterson, East Ohio Gas Bldg., Cleveland, is having plans prepared for the construction of a 1 story garage and warehouse, here. Estimated cost $40,000. Private plans.

Pa., Johnstown—The Penn Public Service Co., 535 Vine St., is having plans prepared for the construction of a 2 story, 56 x 106 ft. garage on Lind St. Estimated cost $70,000. C. J. Lane, c/o owner, Engr.

Pa., Lewistown — The Lewistown Motor Co., c/o D. and B. Wollner, South Main St., plans to build a 3 story, 88 x 180 ft. garage. Estimated cost $100,000.

Pa., Munhall—The Mervis Garage is having plans prepared for the construction of a 2 story, 25 x 110 ft. addition to garage at 414 East 8th Ave. Estimated cost $40,000. A. G. Wickerham, 517 McClure Ave., Homestead, Archt.

Pa., Sharpsburg—The Natl. Eng. & Machine Co., 19th St. along tracks of Pennsylvania R.R., is having plans prepared for the construction of an addition to its factory. Estimated cost $50,000. A. Weeks, c/o owner, Engr. Noted June 26.

Tenn., Nashville — The Chevrolet-Nashville Co., 109 3rd Ave. N., awarded the contract for the construction of a 1 story, 100 x 150 ft. garage and salesroom on 5th and Broad Sts. Estimated cost $50,000.

Ont., Eastview—The Beeby Range Co., Ltd., Ottawa, plans to build a factory on Montreal Rd., here. Estimated cost $100,000.